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SMITHSONIAN INSTITUTION
BUREAU OF AMERICAN ETHNOLOGY
BULLETIN 76

ARCHEOLOGICAL INVESTIGATIONS

I. CAVE EXPLORATIONS IN THE OZARK REGION OF CENTRAL MISSOURI
II. CAVE EXPLORATIONS IN OTHER STATES
III. EXPLORATIONS ALONG THE MISSOURI RIVER BLUFFS IN KANSAS AND NEBRASKA
IV. ABORIGINAL HOUSE MOUNDS
V. ARCHEOLOGICAL WORK IN HAWAII

BY
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Smithsonian Institution
JAN - 9 1923
260012
National Museum

WASHINGTON
GOVERNMENT PRINTING OFFICE
1922

LETTER OF TRANSMITTAL

SMITHSONIAN INSTITUTION,
BUREAU OF AMERICAN ETHNOLOGY,
Washington, D. C., February 17, 1920.

SIR: I have the honor to transmit the accompanying manuscript, entitled "Archeological Investigations," by Gerard Fowke, and to recommend its publication, subject to your approval, as a bulletin of this bureau.

Very respectfully,

J. WALTER FEWKES,
Chief.

Dr. CHARLES D. WALCOTT,
Secretary of the Smithsonian Institution.

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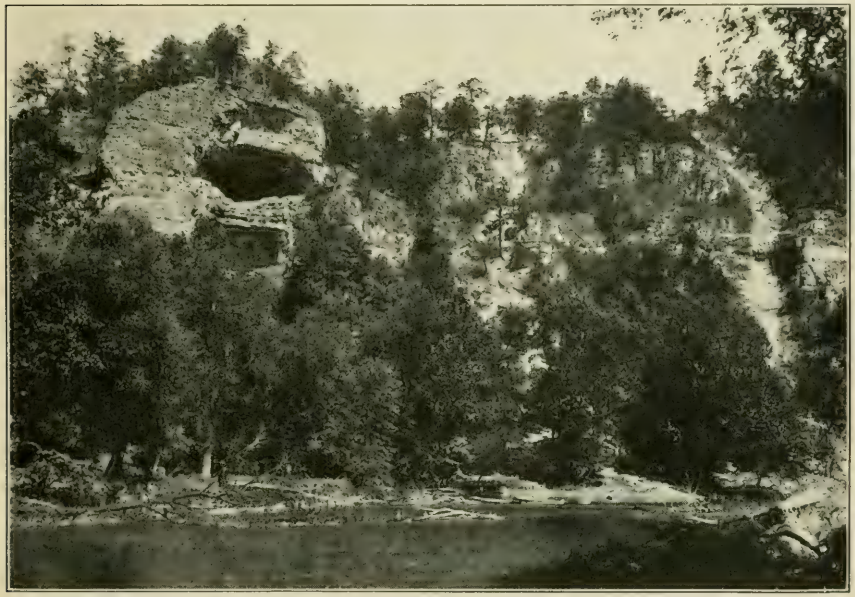

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ARCHEOLOGICAL INVESTIGATIONS

I. EXPLORATIONS IN THE OZARK REGION OF CENTRAL MISSOURI

By Gerard Fowke

INTRODUCTION

The geological structure of that portion of southern Missouri which lies to the westward of the Archean rocks near the Mississippi River is peculiarly suitable for the development of caverns. The Ozark uplift produced far-reaching undulations, and there seem to have been no violent disturbances which would result in extensive faults, considerable displacements, or a pronounced inclination of the strata. Jointing and pressure cleavage, however, gave rise to innumerable crevices in the limestone, through which percolating surface water found its way into all parts of the formations. By its solvent power this water gradually enlarged the crevices into passages which, multiplying and uniting, drained constantly increasing areas until they formed subterranean streams with a perpetual flow. Thus began caverns; and these grew in depth, width, and height as the rock was eroded and dissolved. Tributary crevices were subject to the same action; and there was finally created by each of these water systems a network of cavities whose ramifications sometimes extend throughout several townships. In time, sections of the roof, here and there, became so thin from the combined erosion taking place both above and below as to be unable to sustain their own weight; the overlying strata fell into the cave, and the volume of water flowing through it was augmented by drainage which had previously been disposed of on the surface. All this had to seek an outlet somewhere, except in those rare instances where it maintains its downward course until, below the level of any open stream it can reach, it encounters an impervious stratum and must lose itself in the deep rocks. Usually, however, it emerges in the face of a bluff or on the side of a hill; and the opening becomes "the mouth of a cave." Occasionally, in such situations, the water continues to flow out; but usually it finds a way to reach a lower level, and so the cave in time

becomes dry except for such water as seeps through from the earth immediately above. Sometimes, too, the point of discharge is at or perhaps somewhat below the level of a stream into which it passes; in the Ozarks are numerous very large springs or fountains which by inverted siphon or artesian action are forced up from subterranean streams lying at a greater depth.

Few large caverns have the floor entirely dry, even when they are well above the bottom of the valley. Deposits in the front portion may be dry, perhaps dusty on the surface; but toward the interior moisture usually accumulates until they are muddy or until the water stands in pools or puddles. When this is the case there is sometimes a little stream making its way to the front through a channel which it has cut; or seepage may dampen, possibly saturate, the lowermost portions of the otherwise dry earth. These details are controlled principally by the direction and degree of slopes and by side openings which allow more or less of the water to escape at some part of its journey.

When a cavern is fairly lighted and has a dry floor, whether of rock or earth, it forms an excellent abode for a small community unable or not disposed to construct shelters more comfortable or convenient; and there is abundant evidence that many caves in the Ozarks were utilized as habitations by the aborigines. It must be remembered, however, that in the centuries which have elapsed since hunters or permanent occupants first entered this region, many superficial changes have taken place, not only about the entrances but within the caverns as well. Very probably these alterations have converted caves once occupied into places which at present are quite unfit for such purposes. Talus has accumulated in front of the openings or partially filled the front chambers; it may well be the case that this conceals much refuse. Caves which, from similar deposits, are now difficult to enter and dark to the doorway, may have been open and convenient. Furthermore, caves with wet or muddy bottoms may owe such condition to causes which have recently come into operation; or if they always contained more or less water, the primitive dwellers could in many cases have overcome such disadvantages by digging drains which have since become choked and obliterated. Very small cavities, such as deep rock-shelters; or caverns with a great thickness of earth on the floors, now showing no trace of remains; or those with entrances so small that it is necessary to crawl through—any of these, if cleared out to the bottoms, might disclose material dating back to very early times.

It might seem that the air in a cave constantly occupied would grow stale and close; while smoke from the fires would in time become annoying. But Indians used for fuel only dry wood and bark, the smoke from which would be a negligible factor. The varying

pressure of the atmosphere outside creates a current of air in or out which is usually imperceptible but which penetrates to the deepest recesses and insures ventilation.

In view of the very primitive conditions under which cave dwellers lived, as denoted by the artificial objects which they left, and the low mentality indicated by the skulls, Mr. W. H. Holmes suggests that a careful and extended study of these abodes may disclose a culture lower than that prevailing among out-door dwellers in the same localities. As no effort would be required to secure warmth and shelter, and as food was abundant and easily procured, the people may never have advanced from savagery, or may have retrograded.

None of these possibilities are taken into account when reporting upon the caves described in the following pages; the information offered is based entirely upon the present appearance of the places mentioned. To attempt more would be merely offering guesses.

If "Cave Man"—using this term to designate the predecessor of any race or tribe known to history—ever existed in the Mississippi Valley he would not find in any part of it natural features better adapted for his requirements than in the Ozark hills. But, so far, not the slightest trace of his presence has been revealed. Products of human industry have been reported as occurring at great depths under other conditions, even at the bottom of the loess; though in all such cases there is some uncertainty as to the correctness of the observations. No similar reports have been made in regard to any cave yet explored. On the contrary, whatever may be the depth of the deposit containing them, the artificial objects exhumed are uniform in character from top to bottom; the specimens found on the clay or solid rock floor are of the same class as those barely covered by the surface earth. Moreover, when they cease to appear they cease absolutely; the rock was swept bare, or the clay was deposited, by the stream to which the cave owes its existence, and each is a part of the original formation. In these circumstances habitation would be out of the question.

By careful search in the caves and rock-shelters of which the Indian known to history availed himself, extensive and interesting museum collections can be made. To find an earlier man it will be necessary to investigate caverns which he found suitable for occupancy and in which the accumulation of detritus, from whatever source, has been sufficient to cover his remains so deeply that they can not be confused with those of a later period; and it may be necessary, also, to discover with them bones of extinct animals. Should such a place exist, it is extremely probable that there will be no outward indication of the fact.

No examination of a cavern is complete or is to be deemed satisfactory unless a depth is reached where the geological deposits are

undeniably of such age as to antedate the possible appearance of man upon the scene. This is not assured until the excavation has reached the original floor, which may be either the bed-rock or the clay left by the eroding stream when its volume had become so diminished from any cause that it was no longer able to keep its channel cleared out. Unless a cave is almost perfectly dry—and few of them are—the bottom can not be reached until all standing or soil water has been drained off.

Notwithstanding the most explicit directions, a stranger without a guide is frequently unable to find a cave unless its position is plainly visible from some well-defined spot. The winding valleys and the multitude of ravines sometimes bewilder even those living among them.

A few definitions of terms, or explanations of statements in the report, may prevent misunderstanding.

"Refuse," "signs," "indications," "evidence," referring to habitation or occupancy, mean mussel shells; animal bones; burned or worked stones; broken pottery; wrought objects of bone or shell; flint implements, chips, or spalls; ashes; charcoal; in short, the material ordinarily found on the site of an Indian village, some or all of which are to be seen where the caverns have been used for shelter.

"Daylight" or "in daylight" is the greatest distance within the entrance to a cavern at which common print may be easily read or the nature of small objects lying on the floor determined with certainty.

"Drip rock," "cave rock," or "cave formation" are general terms including stalactite or stalagmite; also deposits of similar origin coating the walls. Not all of these may be present in the same cavern.

"Roof dust" is a substance, literally "lime sand," produced by the superficial disintegration of the roof or walls. This process is greatly accelerated where lichen or rock moss has gained a root hold on the stone. Roof dust in a dry cavern is the equivalent of stalagmite in a wet one.

"Cave earth" is the loose, loamy material usually found in the front chambers of large caverns. It is made up of roof dust, sand, and silt washed from the interior, outside dust and vegetable matter blown in by the wind, with minute amounts of clay or soil carried in by animals.

"Gravel" in a cavern is seldom noticeably water-worn, but is the angular débris resulting from the continued fragmentation of chert nodules released by erosion of the limestone.

A "rock shelter," or "shelter cave," is a room or recess formed by atmospheric erosion in the face, usually at the base, of a cliff. The depth from front to back, under the projecting or overhanging

unremoved bedrock above, is generally much less than the length as measured along the face of the bluff. They are nearly always dry, more or less protected from storms, and when of suitable size and in a favorable location were much used as camping places. They are rather rare in limestone formations but frequent in massive sandstone.

"House mounds" are small, low piles of earth, similar in all respects to those so numerous in southeastern Missouri and southward. Although they are usually described as "standing in regular rows," they are in fact irregularly placed, though seldom as much as 100 feet apart in the same group.

Measurements of caverns explored were made with a tape line; others were estimated by stepping, or in the case of elevations, by sighting, consequently are only approximate, but the figures given will in no case exceed the actual distance.

Specimens reported from caves not excavated were found on the floor, sometimes in situations where no addition of cave earth had taken place since the objects were left there; at other times where they were brought from below by burrowing animals; and, again, where they are exposed in the bed or banks of a drainage channel.

In no cave so far examined has any evidence been found to show that the aborigines occupied any part of it beyond such point as was adequately illuminated from the entrance. No doubt they may, at times, have retreated beyond the reach of daylight and been compelled to dispel the darkness by means of fires; but such instances were rare and of short duration. Statements are sometimes made that specimens, usually flint implements, have been found far, possibly several hundred yards, within the cavern. Such objects do not predicate habitation at that distance; primitive explorers may have lost them. It has been pointed out, too, by Mr. De Lancey Gill, that a wounded animal, taking refuge in a cave and instinctively seeking its dark recesses, may carry in an arrow or spear whose point remains when the shaft has decayed. In the case of a large mammal, such as a bear or a panther, a number of arrow or spear heads might be carried in and be found close together long after the death of the victim.

Cairns or stone-covered graves are of common occurrence; but with a single exception the rocks in all those visited or reported are more or less displaced. This is due to hunters digging out small wild animals making a den in them; to treasure seekers who believe that "money" is concealed in them; and most of all to persons who are curious to know "what there is in there."

The record of the investigations will be given by counties, beginning at the south and proceeding northward. Descriptions and notes of the sites mentioned will follow as closely as possible the

same arrangement. A number following the name of a cave refers to its position as denoted by a corresponding number on the map (pl. 3).

THE UPPER CURRENT RIVER

A number of well-known caverns, some of them quite extensive, exist along the head streams forming the Current River. As originally planned, the work included a thorough survey of this region, but owing to various causes it was only partially examined. Several large caves were reported as being along the river and its tributaries farther down than these researches were carried. Notable is one opposite the mouth of Sinkin Creek, which was described as dry and very large within; but it was also stated that it can only be entered through a sink hole with the aid of a ladder or pole 30 feet long. Such a cave is not likely to have been used for shelter. Others, as they were described, seemed equally unfitted for this purpose. The only exception to this general rule is one in Spring Valley south of the Current and east of Sinkin.

Such as were visited will be described in their geographical order.

SHANNON COUNTY

BAT CAVE (1)

This cavern is 6 miles above the mouth of Sinkin. It is near the top of a cliff, fully 300 feet above the river. The entrance is 30 feet wide and 10 feet high; within is a level earth-covered floor. Being very difficult of access, it was probably never inhabited.

BLUE SPRING, OR FISHING CAVE (1)

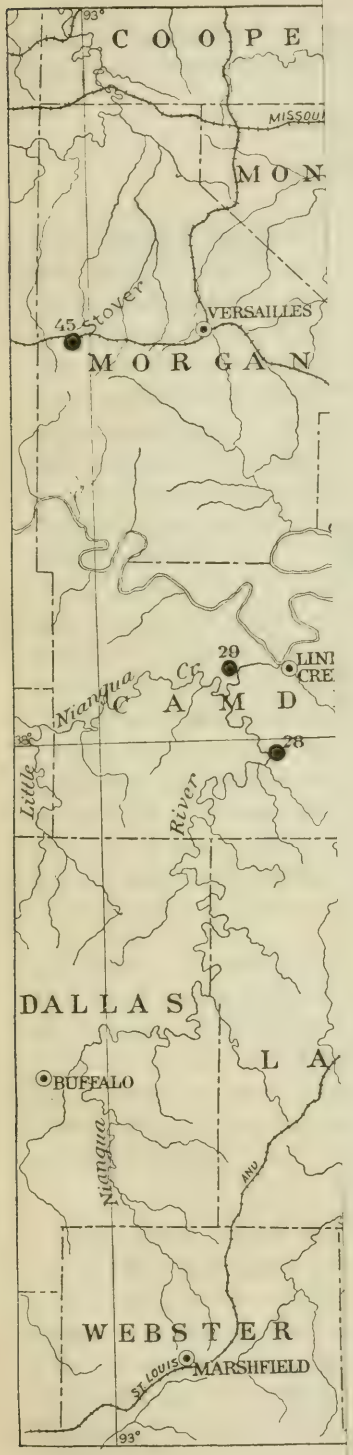
This is situated on the Terrell land, 4 miles below Akers post office. The entrance, 10 feet high and 20 feet wide, is almost at low-water level; the river at flood height rises fully 20 feet above its top. Fifty feet within is a spring or well, 20 feet across, whose bottom is beyond the reach of a line 60 feet long. It is said that eyeless fish of 3 pounds weight have been caught in this "Blue Spring."

WELCH'S CAVE

This is 4 miles below Cedar Grove. It can be entered only in a boat, and the entire floor is deeply covered with soft mud.

BIG CREEK CAVE

There is a cave at the mouth of Big Creek which is often used as a temporary camping place by hunters and fishermen. The water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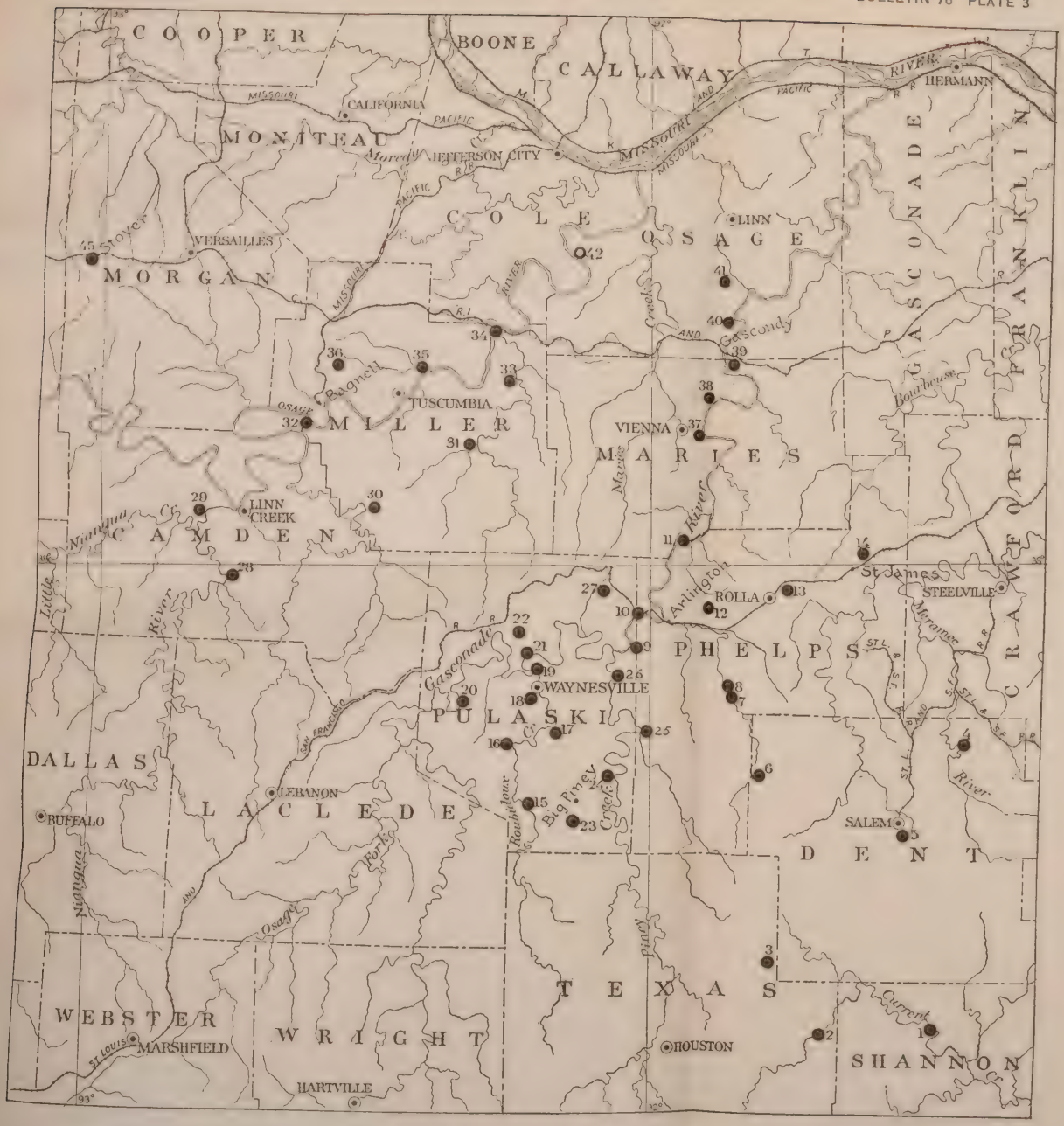


MAP OF AREA EXAMINED

(Numbers refer to corresponding numbers in text)

enters it whenever there is a freshet in either the creek or the river; so it could never have served as a place of permanent abode.

TEXAS COUNTY

SMITH CAVES (2)

On James I. Smith's land, on Big Creek, a mile above Niles, are three caves. One is merely a round opening 5 feet in width and height, soon narrowing to a crevice; it would not be mentioned except that in it was a sandstone slab such as mortars are made of. This bore no marks of use; but it had been carried in for some purpose—possibly by white men.

The second cave, 50 feet from the first, has an entrance 20 feet wide and 4 to 5 feet high. Dry earth extends back for 40 feet; then come clay and fallen rocks, sloping downward toward the rear. The roof maintains its level as far as followed. No trace of occupation could be found.

The third cave, 150 yards from the second, has an entrance 35 feet wide and 20 feet high. Dry cave earth appears for 20 feet, at which distance it merges with mud containing large rocks. The cavern extends for 50 feet in daylight; water from the interior spreads over the whole floor to the inner margin of dry earth, where it collects in a little stream which passes out along the foot of one wall. The earth deposit seems to be thin. The only objects that could be found in the cave or about the entrance were a small sandstone slab, unmarked; a small piece of deer bone; and one fragment of shell-tempered pottery. Not a flake of flint was seen.

These caves are not worth working.

A fourth of a mile from the cave last mentioned is a rock grave on a ledge which projects at about 40 feet (vertically) below the top of the hill. As near as can be judged, in its present torn-up condition, the cairn was originally about 10 by 20 feet in dimensions; so there were probably two graves covered by the ordinary conical heaps of stone, the depression between them being filled up to form a single cairn.

SALTPETER CAVE (3)

Five miles west of Montauk, on Ashley Creek, is a cave noted for having two entrances which are separated by a triangular mass of rock, part of the original formation. This partition measures 30 feet across at the face of the bluff and terminates within 20 feet. The principal opening is 90 feet wide and 15 feet high. Dry cave earth extends back 90 feet, at which distance water constantly falls from the roof and flows along the foot of one wall through the minor

entrance. The latter is 30 feet wide, 10 feet high, and its bottom is 10 feet lower than that of the main opening. The volume of water passing out varies with the seasons, but is sufficient at times to cover the entire floor of the side chamber and keep it swept free of earth and small gravel.

In the front portion of the main cavern the dry earth is 5 feet deep in its thickest part; but as it has all been leached for obtaining the saltpeter or niter diffused through it, none of it is in the original position. Some earth has also been brought from farther back, leached, and added to the pile in front; and much of this has been hauled out for fertilizer.

Near the main entrance is a large mass of breccia made up of small angular limestone fragments cemented throughout with stalagmite material; it projects several feet above the present level of the earth floor, so the character of the cavern must have changed greatly since this deposit was formed.

The only artificial object found was a fragment, about an inch across, of dark, sand-tempered pottery.

Owing to the extensive changes resulting from collecting the saltpeter, the cavern would not repay investigation.

DENT COUNTY

MAMMOTH CAVE

The statement has been made that a large dry cavern, known as the "Mammoth Cave," is in a bluff facing Current River, opposite the mouth of Ashley Creek. It could not be located; and residents in the vicinity assert that not only is there no cave near this site, but there is none known as "Mammoth" anywhere in the region. Some of them, however, had a vague idea that a cavern bearing the same name exists "away down toward Eminence; it may be on Jack's Fork."

GUTHOERL CAVE

There is a cave on the farm of Peter Guthoerl, 6 miles east of Salem. It is small, with very little level space in front of it, and water from the interior runs or seeps out of it, keeping the floor muddy throughout the year.

SHORT BEND CAVE (4)

Short Bend post office is 12 miles northeast of Salem. Half a mile east of it, in a bluff on the opposite side of the Meramec River, is a cave with an entrance 25 feet wide and about the same in height; the roof forming a fairly symmetrical Gothic arch. Were

it not for the pile of talus in front, water from the river would pour into the cavern in extreme floods; these subside very rapidly, however, and have never percolated through the barrier.

It is said that persons digging in a desultory way have unearthed bones which were assumed to be those of Indians because they were "red." No description of them could be obtained, and they may not have been human bones at all.

The floor is level and dry for about 80 feet back from the entrance, but no refuse of any kind appeared, except in the pile of talus outside, which showed a small quantity of flint chips such as would be left by hunting parties in repairing their weapons.

MONEY CAVE

This is a fourth of a mile down the river from Short Bend Cave. It takes its name from the customary tradition that Indians concealed a large treasure here; the legend being authenticated by an "Indian chief" who told a white man that his people had buried much gold in a cave in this bluff, built a fire over the money, then filled the mouth of the cave with earth and rock. Some of the persons who opened many small holes in searching for the hidden wealth claim to have found ashes in this cave, behind the barrier, which is only ordinary talus. The floor is of tough clay, fallen rocks, and stalagmite, all of which, as well as the walls and ledges, were industriously dug and hammered for months by the treasure seekers.

A cave with an entrance 15 feet wide, the same in height, and having a depth of 45 feet in daylight, lies between Money Cave and Short Bend Cave. In very wet seasons water runs through it from the interior; and high water backs into it from the Meramec River.

SALTPETER CAVE

This is three-fourths of a mile north of Short Bend post office, on the opposite side of the river. The arched entrance is 25 feet wide and 20 feet high. Fifteen feet from the front the cave divides into two branches about equal in size; they have never been explored to the end. One branch continues straight back for about 100 feet, then turns abruptly to the right for 50 or 60 feet, at which distance it resumes its original direction. The other branch turns directly to the right and is in daylight for 50 feet. Much of the cave earth has been hauled away for fertilizer, or leached for obtaining saltpeter, so that only a small quantity remains in front. Farther back, in both chambers, the dry earth where not disturbed is 8 to 10 feet thick.

The cavern is easily accessible, close to the river, and otherwise well adapted for habitation; but careful search failed to reveal any indication that it had ever been thus used.

WATSON, TWIN, OR ONYX CAVES

The two caverns thus variously designated are on the Meramec River, 14 miles north of Salem. They are parallel to a depth of about 100 feet, being separated by only 10 or 12 feet of solid wall. The floors of both slope downward from front to rear, but not so rapidly as the roof, so that at this distance the caves apparently come to an end. But that they continue back into the hill is manifest from the appearance of the roofs. In some manner the rear portion of each has become entirely filled with earth. Probably they unite somewhere beyond this point.

Either of these caves is of ample size to make an excellent shelter for a large number of people; but they are difficult of access, and no evidence whatever could be discovered indicating occupancy.

In fact, this part of the Meramec Valley does not seem to have ever been permanently inhabited. Residents say that relics, even flint implements, are seldom found in the bottom lands; and this fact was commented on by persons who have learned how common such things are in other localities. Small, rough hematite axes, however, occur in considerable quantities throughout the region. The ore outcrops at various places and solid nodules or fragments are plentiful. Chert knives or spearheads are found scattered promiscuously; and, rarely, an object made of other stone may be picked up. Very few specimens of any description are symmetrical or carefully finished.

HOUSE MOUNDS (5)

On the Dent County infirmary farm, in Spring Creek Valley, a mile and a half south of Salem, is a group of house mounds, about 50 in number. They have not been much disturbed by cultivation; the creek and a drainage ditch have cut through several of them, but, as usual, there is nothing in the construction to show their purpose.

Two similar groups are on the Short Bend road, not far from Salem; another group on Peter Guthoerl's farm 6 miles east of Salem; and a fourth group, partly within the corporate limits of Salem, on the road to Rolla.

PHELPS COUNTY

BATES CAVE

On the farm of J. W. Riden, 6 miles southeast of Big Piney post office, is Bates Cave, of which every visitor to the region is speedily informed. It is entered with difficulty by sliding feet first down the inner slope of a pile of débris which fills the entrance almost to the

roof. Once beyond this, there is ample space. On the hillside, above the mouth, is a vertical shaft, like a well, due to the widening of a crevice; access to the interior of the cave may also be had through this by means of a long rope. Under present conditions, it would not be used except as a temporary shelter or hiding place; for which purposes bushwhackers availed themselves of its advantages during the Civil War.

This cavern is renowned far beyond its merits on account of its famous "ballroom," where dances and picnics are held; artificial lights being placed on the walls. Possibly the manner in which it must be entered has something to do with its popularity.

ANOTHER "BATES CAVE"

Within a few rods of the cave above described is another, with an entrance 60 feet wide and 10 feet high. Cave earth, which is 5 feet thick above the bottom of a small stream coming from the interior, extends back to large rocks covering the floor; beyond these are rocks, wet clay, and gravel. The cave earth seems to run for some distance under the receding walls. A milk house has been constructed in it, so that excavations are not permitted.

RENAUD CAVE

Four miles east of Edgar Springs, facing Little Piney, is Renaud (Rĕn′nō) Cave, on the farm of Charles E. Widener. The entrance is 50 feet wide and 10 feet high. Dry cave earth extends back for 65 feet, then comes fallen rock for 100 feet or more. A little stream runs close to the north wall. Cave earth is 5 feet deep on the bedrock at the entrance and rises toward the interior. There is much refuse within and also on the slope in front of the entrance.

MARSH CAVES

A shelter cave on Henry Marsh's farm, facing Little Piney, 2 miles south of Yancy Mills, has a front 35 feet wide, 15 feet high, and runs back 60 feet. There is a wet-weather stream bed through the center. Bedrock shows at the entrance, rising toward the rear for a few feet, then becoming covered with cave earth, which probably has a maximum thickness of 2 feet. There is considerable refuse scattered about, but it is doubtful whether the shallow deposit would repay investigation.

WILD-HOG CAVE

A fourth of a mile from the above cave is one known as "Wild-hog Cave," because in pioneer days these animals gathered here for shelter and protection. It is a small, tunnel-like affair, with a solid rock floor, and extends farther into the hill than anyone has ever dared to venture.

SHELTERS

Two small rock shelters near the Wild-hog Cave may have been resorted to as temporary camping places.

PHELPS CAVE

A cave on the farm of James Phelps, 2 miles south of Yancy Mills, is described as small, with a narrow entrance.

"KEY ROCKS"

Near Yancy Mills there is something known as "the Key Rocks." It can not be found by a stranger and no guide was available at the time the place was sought. It is described as a small, deep, circular hole in solid rock, in which were many stone covers or lids, one above another, gradually diminishing in size and "cut to fit down on each other." It is probably due to stream erosion.

JONES CAVE

On Little Piney, half a mile south from Yancy Mills, is a large cave on the Jones farm. It is said to have a large entrance and much earth on the floor. As the owner uses it for a warehouse in which to store fruits and vegetables and utilizes the stream flowing through it for preserving milk and butter, no examination could be made.

YANCY MILLS CAVE

There is a small, shallow cave near the top of the bluff, half a mile north of Yancy Mills. It contains no evidence of occupation, except that walls and ceiling are blackened with smoke, due, probably, to modern refugees or hunters.

LANE MOUND (7)

It was reported, too late to visit the site, that on George Lane's farm, on Little Piney, a mile north of Yancy Mills, is a mound "8 feet high, built of earth," and surrounded with the usual evidences of a village site, scattered over the level bottom on which it stands.

CAIRNS ON LOST HILL, AT MOUTH OF GOURD CREEK (8)

Gourd Creek flows into the east side of Little Piney River 12 miles southwest of Rolla. It is less than 4 miles long, and but for three or four large springs near its source, which keep its volume fairly uniform, would be dry most of the year.

Parallel with it, a short distance to the southward, is a ravine several miles in length, known as Coal Pit Hollow. This originally

discharged its drainage into Little Piney about half a mile above the mouth of Gourd Creek. A ravine tributary to the latter, near its mouth, has worked back until it has captured the flow of Coal Pit. The lower end of the stream bed thus abandoned now forms a gap or depression with a slight incline from the center in both directions. The crest of the deserted portion is about 50 to 60 feet above the present level of Little Piney. The hill inclosed by this quadrilateral drainage is about a fourth of a mile in length along its top, has a direction almost north and south, with a nearly uniform slope along the summit, the southern point being somewhat higher than that at the north, and terminates abruptly at each end. The sides descend at once from the center line of the ridge, like a roof with a slightly rounded comb.

On account of its isolated position the eminence is locally known as "Lost Hill." It is not to be confused, however, with several similar formations in this region, to which the same term is applied and which may owe their existence to a like cause, or may be due to cut-offs by streams.

On the top of this particular Lost Hill are six cairns, five of them near the northern end, the sixth just where the ridge breaks off to the south. The margins are uncertain owing to the upper stones being scattered by hunters as well as by credulous individuals who are firmly fixed in the belief that all such "rock piles" contain gold hidden by Indians.

So far as can now be determined the five at the northern end were 16 to 18 feet across as left by the builders, the southernmost one being somewhat smaller. All are in uncleared land, and crevices between the stones are filled with a tangled mass of roots from the trees and bushes growing on and around them.

The relative positions are about thus, measurements being made on the earth between the scattered stones: (1) 10 feet, (2) 10 feet, (3) 50 feet, (4) 10 feet, (5) 1,000 feet, (6). The distance from (5) to (6) is estimated by stepping and may vary considerably either way from the measure given.

Cairns (1), (2), and (3) were thoroughly excavated.

Cairn (1)

This, the farthest north, was about 16 by 17 feet within the original limits. When the outer loose rocks were removed there was disclosed a wall of flat stones on the natural surface, so laid as to form an inclosure apparently intended to be practically square. It measured, across the center, from outside to outside, about 14 feet from north to south by 12 feet from east to west. The north and south walls

were straight, the others outwardly curved. The approximate outline is shown in figure 1. In most parts the wall was only one stone high; in a few places there was another rock laid up. Over and within this wall had been piled loose stones, ranging in size from small pebbles to fragments of 150 pounds in weight, to form a heap whose original height was about 2 feet.

FIG. 1.—Outline of Cairn (1), at Lost Hill, Phelps County, Mo.

When all these were cleared away the space within the wall was found to measure 9 feet in each direction. Three feet from the middle of the west wall was a fragment of a child's skull lying on the undisturbed angular gravel which forms the natural surface on this ridge except where a small amount of recently decayed humus may be held by rocks and roots. Halfway between the center and the north wall was the top of an adult skull, with three fragments of long bones. These, which were much gnawed by rodents, were in black earth, evidently the former home of some burrowing animal.

A foot north of the infant's skull were small remnants of an adult's skull, probably belonging with the piece first found. There were also some scraps of animal bones, much gnawed.

CAIRN (2)

This measured from 16 to 18 feet across to the outer edge of the loose stones, and about 30 inches high. Under the top rocks was a rough wall similar to that in Cairn (1), but all the sides were nearly straight. The outline is given in figure 2. The outside measurements, across the center, were 15 feet each way. There were more stones in this wall than in the first; mostly there were two, and in some places three, superposed.

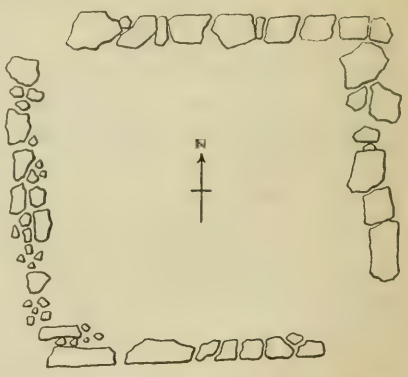


FIG. 2.—Outline of Cairn (2), at Lost Hill, Phelps County, Mo.

Extending from north to south across the middle of the vault was a row of large slabs standing on edge with their tops leaning toward the east. Their inclination varied from nearly horizontal to nearly

vertical; so it would appear that they were not placed thus intentionally but had settled irregularly. Probably they had formed the covering of a pen or vault, of poles or timbers, in which a body had been placed.

Close to these inclined slabs, near the north wall of the vault, was the effigy pipe shown in figure 3. It is made of a fine-grained sandstone and seems intended to represent a buzzard with an exaggerated tail, though the beak is more like that of a crow. This specimen lay between two flat rocks which were separated by a little earth and gravel, but there were no traces of bone with it or near it.

At a slightly lower level than the pipe were several flat stones standing at various angles. When these were removed there were found fragmentary remains of at least three adults, lying in confusion, as if only the folded or dismembered skeletons had been placed here. They lay on a floor of slabs which, in turn, rested upon undisturbed gravel.

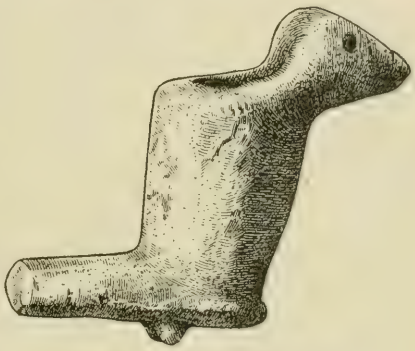


FIG. 3.—Pipe from Cairn (2).

The facts observed are difficult to interpret, as the original order was so broken up; but it would seem that as a preliminary to the burial of bodies or skeletons, the superficial earth had been scraped away and a rough stone floor laid, on which the bundled or folded remains were placed and at least partially covered with earth and gravel. Other flat rocks were then laid over them, either directly on the earth or more probably supported by poles placed across, whose decay had allowed them to fall into the confusion in which they were found.

A small flint knife was among the remains.

The pipe, being at a little distance from these bones, would suggest another interment; but as no trace of such remained it may have been placed as an afterthought or a separate deposit.

From these skeletons row after row of the slanting rocks continued to the inner side of the eastern wall. Two feet east of the pipe was a skull on its right side, the back against a small flat rock. It was crushed flat, and only a small part of it remained. Possibly it had turned after burial, as fragments of other bones were found here and there toward the south from it, indicating an extended burial. The teeth were hard, solid, and much worn. The bones found were more or less gnawed, and among them were scraps, probably of food

animals, burned into charcoal. No bones found could be saved, as they were very soft.

CAIRN (3)

This was similar in construction to (1) and (2), as is shown in figure 4. The wall, along the outside, measured 14 feet on the south, 13 feet on the north, 15 feet on the west, and 14 feet on the east. The inclosed space was 10 feet across each way. Some one had dug out much of the south end; the northern end was undisturbed.

The prior excavation had barely missed, near the west wall, a few fragments of an adult skull and three teeth. About even with the middle point of the west wall, 2 feet from it, was evidence of the burial of an adult—pieces of bone and skull, and some teeth. North of these, near the northwest corner, were fragments of two adult skulls, with one of which were some beads made of shells of water snails; 18 of these were recovered, all more or less decayed. Between these two skulls were parts of a child's skull, the teeth not yet through the bone.

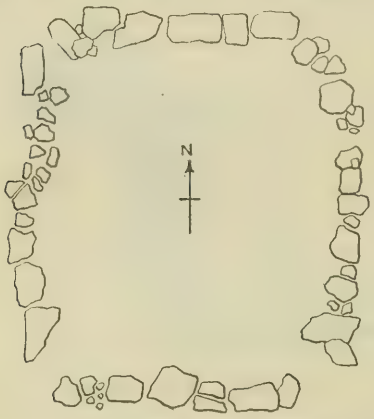


FIG. 4.—Outline of Cairn (3), Lost Hill.

Inclined flat stones in the eastern half of the grave, the tops leaning eastward, denoted other burials; but nothing was found under them, although small flat stones laid on the original surface indicated the bottom of a grave.

Evidently several burials, of which all traces have disappeared, were made in this vault.

Owing to the practical identity of these three graves, the poor returns, and the difficulty of working in a tangled mass of tough roots without displacing the stones so greatly that their proper position became a perplexing question, the remaining three were not excavated.

EXPLORATION OF THE GOURD CREEK CAVE (8)

Near the mouth of Gourd Creek, on the north side, is a cave which has acquired much local reputation from its size and also from the evidence it affords of a long-continued occupation by the aborigines. It is easily reached from the road which passes in front; wagons can be driven into it and there is ample space for them to turn and pass out. Formerly it was much resorted to as a pleasant place for

social gatherings; but in recent years it has been used as a barn and storehouse. The owner, Mr. Valentine Allen, gave cheerful permission for all the excavation that was desired, subject only to the proviso that the floor be put back in condition suitable for the purposes for which he needed it. And it is only fair to state that he was not at all difficult to satisfy in this respect.

A stream coming from the interior had a flow at the close of the long drought in 1918 sufficient to fill a 2-inch pipe with a rapid fall; in wet seasons the water spreads from wall to wall until it comes to within 100 feet of the mouth.

Back in the cave, where the slope is greater, it has sufficient volume and force to carry away all pebbles smaller than coarse gravel and the material that finds lodgment among the stones.

The cave is easily traversed for almost 600 feet; beyond this are narrow crevices and tortuous passages, where explorers must frequently crawl or clamber. One adventurous party proceeded until they reached an opening on the other side of the hill; but this was so choked by fallen rock and débris from the hillside as to be impassable. In storms a strong breeze passes through the main entrance, in or out in accordance with the direction of the wind.

Owing to the irregular outline of the cliffs, the width of the entrance can not be accurately given. From side to side, well under the front of the ceiling the distance is 110 feet. Two hundred feet toward the interior it contracts to 50 feet. At the entrance the walls are vertical to a height of 25 feet; a short curve at the top on either side, due to the breaking away of the ledges, connects them with the roof, which is somewhat higher. Being a single massive stratum, the top is practically horizontal, but the floor constantly rises from the front with a slight and fairly uniform grade. The front chamber is straight and well lighted for 300 feet, where it turns abruptly westward; from this point the floor is solid rock which the water keeps comparatively free from any loose matter except heavy blocks from the walls or top.

Beginning at the entrance is a deposit whose farthest extension reaches 100 feet into the cavern. It is composed to a small extent of sand and clay carried by the stream, and of earth blown or washed in from the outside; but, as investigation proved, it is mainly ashes from prehistoric fires. The surface of this deposit, especially toward the inner end, is very uneven, being higher near the walls than through the central portion. This is due to two causes: In very wet seasons water has carried away much of it, and a large amount has been hauled out by the owner to scatter over his fields as a fertilizer. He reports that in the course of this work he found quantities of pottery fragments, broken bones, flints, and "two or three" human skeletons, with fragments of others. This is the basis for the assertion, fre-

quently heard, that "many" or "very many" burials had been made here. The only human remains which he saved are the complete skull of an adult, remarkably preserved and apparently that of a white woman; a rather large lower jaw, of a man; a few long bones; and parts of skulls and jaws of three or four children.

From comments made and questions asked by visitors while the investigation was in progress, it seems that bones and teeth of deer and other animals are mistaken for those of people. No human bones were uncovered in this work, except as noted below.

There is a firm belief in the community that somewhere in this cave is concealed $100,000 in gold, seven "pony loads" in all, which was put here by an old squaw, sole survivor of a massacre by which her tribe was exterminated. Much of the irregularity of surface noted in the deposits is due to the efforts of persons trying to find this money.

Before starting the work it was necessary to deepen the little stream, which had cut its way through the accumulation much nearer to the western than to the eastern wall of the cavern, in order to allow the water to run out of the lower end of the deposit. Thorough drainage of the whole mass was impossible, as water continually seeped in from the gravel bed farther up, a condition which could not be remedied.

Bedrock was reached at a depth of 3 feet below the channel. The lower 2 feet of this distance was through a black, mucky substance which was so tough and sticky that removing it was like digging through a bog.

Following the bedrock as a floor, the western side of the deposit was first examined. It had a width of 35 feet at the mouth of the cave, gradually narrowing inward for a distance of 75 feet, where it terminated at the level of the water. Its greatest elevation, at the side of the entrance, was about 10 feet; but this does not mean that its thickness was so much at any point, as the rock sloped upward quite as rapidly as the surface. So many stones were scattered through it, fallen from the sides and roof, or rolled in from the outside where they had broken loose from the cliff, that not more than one-fourth of the area could be excavated. These rocks varied in size from cobblestones to blocks weighing 3 or 4 tons. They were at all levels, some lying on the rock floor, others only slightly imbedded in the earth. Yet the superficial accumulation extended under all of them except such as were in direct contact with the bedrock, proving that the cave was occupied throughout the period in which such downfalls occurred. An additional evidence of age is the fact that the usual débris, such as bones, flints, pottery, ashes, etc., lay in immediate contact with the bedrock where this has weath-

ered to a chalky consistency from 2 to 4 inches in depth since these objects were left there.

Owing to the uneven surface of both the bedrock and the deposits on it, the thickness of the latter varied from 1 to 3 feet—not including the muck, which last, however, disappeared at the level where the rock rose above the water line. But, whatever the depth, more than half the overlying material was pure ashes; either resting undisturbed on the fire beds, or piled in irregular masses, where they had been thrown to get them out of the way. The largest ash bed was near the wall; it measured from 4 to 7 feet across, with a very uneven outline, as if many fires had been made there at different times.

The objects discovered included flint knives, spearheads, arrowheads (mostly broken), with many spalls and chips; potsherds (only very small pieces were found); animal bones; mussel shells; bone perforators; chert nodules, more or less flaked; two stone beads or buttons; a small fragment of a pipe; but no mortars, hammers, pestles, cooking-stones, or hatchets, such as are usually found on the sites of Indian villages. None of the pottery was decorated, but most of it was cord-marked, though some of it was so smoothed and polished as almost to appear glazed. It varied through a wide range of color, thickness, and general appearance, and was noticeably deficient in quantity. In fact, the west side of the cave had less the appearance of a permanently occupied site than of a camping place which was used as a temporary resort by traveling or hunting parties; but at the same time the depth and amount of ashes showed that it had afforded shelter through a long period.

The excavation on this side included all the space bounded by the ditch, the wall, the mass of rocks piled at the entrance, and the water-soaked earth toward the interior. The muck, and the large blocks scattered around, prevented a complete clearing out; but the part thoroughly examined had an area of about 600 square feet, perhaps a little more. No human bones were found, in spite of reports of their discovery and reburial by treasure hunters in the past; and there was wide disagreement on the part of visitors, who were also present when the bones were found, as to the number of such interments. All finally conceded that there was only one adult skull, though there was much argument as to the number of children's remains discovered, the person who was blessed with the largest memory insisting there were 13 " all in a pile." There was also some discussion as to whether the remains were actually found near the west wall or had been carried over there and reinterred after being exhumed on the east side.

These particulars are given merely to show how little reliance is to be placed upon the statements of perfectly truthful persons who

do not observe closely, whose memory plays them tricks, who are not especially interested in the matter under discussion, or whose recollections naturally become jumbled after several years have elapsed.

Work was next begun on the east side, at the edge of the drainage trench. Bedrock was reached as before, under 2 feet of muck, and was weathered until quite soft and of a yellowish hue, for 3 or 4 inches below its surface. An effort was made to keep on the rock as a floor, removing all the muck; but this was so water soaked, so tenacious, and so filled with chert and limestone gravel that it could not be managed with either pick or shovel. A little of the gravel had no doubt fallen from the roof; but nearly all of this mingled material had washed down from the interior, as it was entirely similar, except for its dark color, to that forming the floor farther in. Consequently it was necessary to limit the explorations to that part of the deposit which lay above the wet black mass. Numerous attempts were made to ascertain the thickness of the latter; but water, gravel, and slush oozed or slid into the hole as fast as they could be removed, and it was impossible to reach the bottom. The eastward dip of the rock floor, as noted on the western side of the cave, no doubt continues entirely across. If such be the case, then the original drainage line was against the foot of the eastern wall. Later, because the channel was obstructed by talus, the stream was forced more and more to the west, saturating, up to the level of its final outlet, the earth and ashes which had accumulated. It may be, however, that either this line of drainage, or the mass of talus in front of the cave, is of comparatively recent origin. Such accumulations as those described would be impossible under present conditions. At any rate, this deposit of muck, then dry, started from the floor of the cave with the earliest occupation; for artificial objects of the same character that occurred in the dry deposit above were found in it to a depth of 3 or 4 inches. They may continue to the bedrock, but on account of the standing water no satisfactory observations could be made below the level indicated.

Lying above the muck and, as intimated, practically continuous with it, was an accumulation of ashes with which here and there some earth was mingled, though the latter made only a small proportion of the entire mass, and was sometimes entirely lacking from top to bottom. They were principally in strata or irregular layers, lying undisturbed where fires had been made; but there were also many scattered piles, usually small, where they had been thrown to get them out of the way.

The excavation on the eastern side began with a trench 25 feet wide. When this had been carried about the same distance toward the wall, rocks and earth rolled and washed in from the outside were encountered on the right, the side toward the mouth of the cavern.

These reached from the bottom to the surface, and were continuous with the bank of talus. As results had been meager along here, the sides of the trench were turned to the northward and northwestward. The entire trench was 43 feet long and varied in width from 30 feet in the central parts to 18 feet at the extreme northern end. The left face reached, in its entire length, nearly to the drain; on the right side the eastern wall of the cavern was uncovered for 15 feet. It embraced nearly all the area not previously dug by others, except a triangular space at the east side of the entrance, filled with large stones, as just stated.

Near the middle of the excavated area was a heap of large fallen rocks, fully a carload in all; some of them imbedded in the muck, others barely penetrating the surface of the latest deposits. Ashes lay under and between all of them, proving this side also had been inhabited before the first of them had become loose, and that occupancy was practically continuous until the last one had fallen. The inmates, recognizing the danger, may have knocked these down.

The greatest depth of ashes found in any part of the excavation was 7 feet; but it may have been greater previous to any disturbance; nor does this include such as may be present in the muck. There were unbroken layers as much as 8 inches thick covering spaces 5 to 10 feet across; many smaller, intact patches; and numerous masses, from a peck to a bushel in volume, removed from fire beds elsewhere. Charcoal among them showed that bark and dead wood, principally oak, was the main reliance for fuel.

The wrought objects found were flints, mostly broken or of rough finish; very many small fragments of pottery; mortars made of sandstone slabs; hammerstones or pestles; bone perforators; mussel shells, some pierced for suspension or for attachment of a handle, some with outer surfaces and edges dressed for use as spoons; hematite ore, in the rough or rubbed to procure paint. There was a great abundance of bones from animals used for food, mostly deer, though elk, bear, many smaller mammals, turtles, tortoises, turkeys, and other birds were well represented. Singularly enough, when the plentiful supply of fish in all the streams of this region is considered, none of their bones or scales were found, although the ashes would have preserved them perfectly. Nor were there many burned rocks, in view of the amount of pottery and the number of bones which showed that they had been boiled. Perhaps such stones had crumbled or were thrown outside when near disintegration.

There is a consensus of belief, or at least of statement, in the neighborhood that many human skeletons have been dug out close to the east wall. In the only part reached during this work—which took in about all that had not been searched by others—rocks lay along the wall, so large and so numerous that no graves could have

been dug behind or between them. By careful and persistent questioning it was established that skeletons had been found in two places and a detached jaw in another.

A human skull, which was very soft and fell to pieces when uncovered, was found on, and slightly pressed into, the muck at a point 15 feet from the wall; there were no other bones about it, though a rough stone hammer, whose presence was probably accidental, lay close by. A single human molar was lying among some ashes.

These were the only human remains found during the work, except two adult femurs of different individuals, and fragments of a skull and some other bones from a child and from an infant, all of which lay close to the wall where they had been thrown and slightly covered by parties previously working here.

As the depth of the wet material on the rock floor of the eastern side of this cavern is unknown, interesting results might be obtained by a careful examination of it; but this can not be made until a ditch is dug through it of sufficient depth to drain it thoroughly.

Slight investigation outside the entrance showed a large amount of broken bones, pottery, and flint; and this dump may contain even more material than was found in an equal volume in the cavern. But in addition to the rocks of all sizes broken off from the cliff, there were also many which had rolled down from the hillside above; and all these were so interlaced with roots as to make digging very difficult and unsatisfactory. Consequently further exploration at this site was deemed undesirable.

Pointed bone and antler implements from Gourd Creek Cave are shown in plate 4. A shell knife, a bead from a fragment of sea shell, and types of flint arrowheads appear in plate 5.

There is a village site on Gourd Creek bottom, at the foot of Lost Hill, and a little below the cave. Three small earth mounds are plowed nearly level.

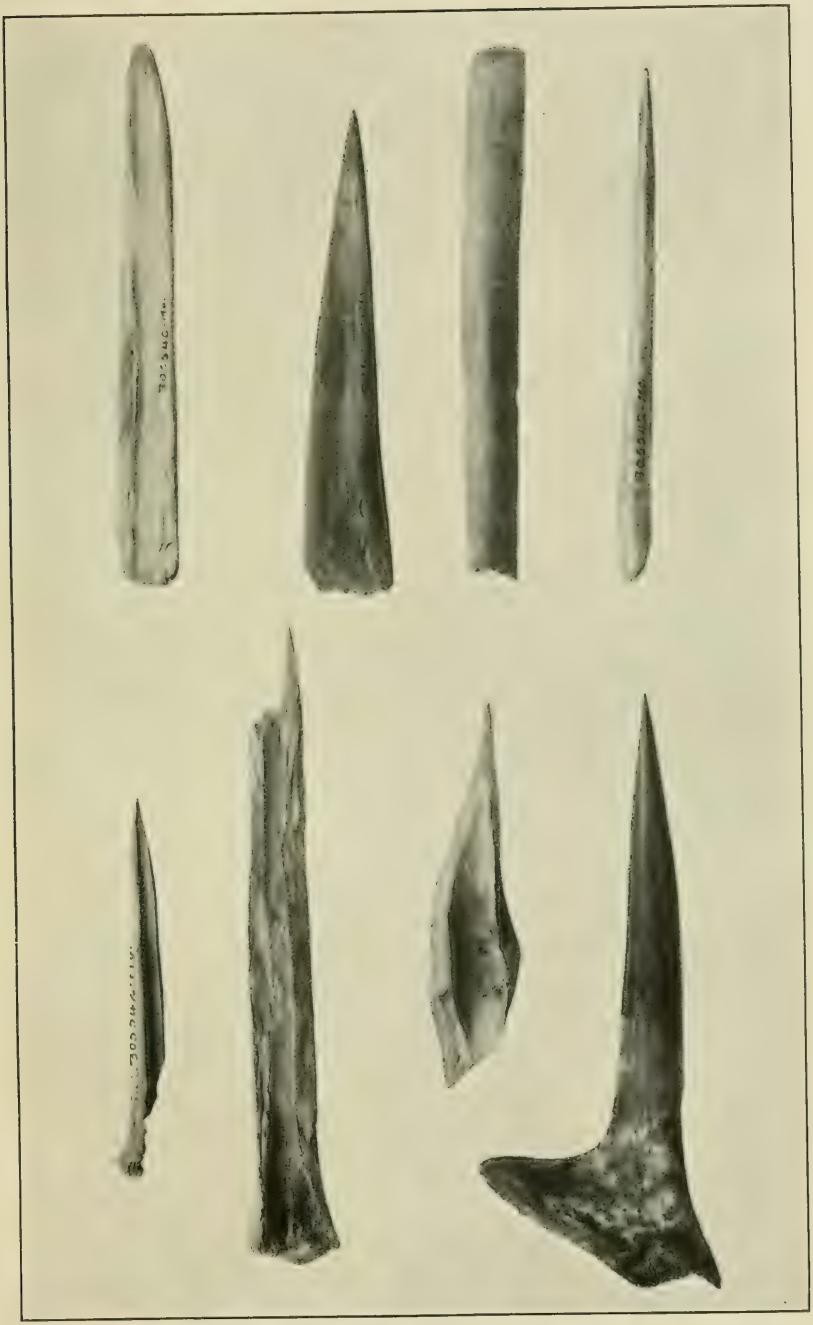
A small village site is located on the east bank of Little Piney, half a mile below Gourd Creek.

In the bluff facing Little Piney, a mile below Gourd Creek, on the opposite side, is a small, shallow cave with a low roof. Water cracks on the floor show that it is sometimes flooded. No signs of use are apparent.

On the hill over the cave just mentioned is a cairn, now destroyed.

ONYX CAVE (9)

Five miles southwest of Arlington, near the Boiling Spring in the Gasconade, is Onyx Cave, so named because much workable stalag-



BONE AND ANTLER IMPLEMENTS FROM GOURD CREEK CAVE, PHELPS COUNTY, MO.

SHELL AND FLINT OBJECTS FROM GOURD CREEK CAVE

mite occurs in it. It has a number of branches, some of which have been explored for several hundred yards without coming to the end. The entrance is 90 feet in width. A pile of talus at the front, lying partly inside the cavern, reaches nearly to the roof; it has a height of 26 to 28 feet above the level of the wet, muddy floor. Drainage is through a small aperture in the north wall, whose outlet is not known. Apparently the bedrock lies at a considerable depth; it is not visible at any point in the steep ravine leading from the mouth of the cave to the river. Formerly a large quantity of ashes covered much of the inner slope of the talus, where it is protected from the weather; but most of them have been hauled away to scatter over the fields. They extend to a greater depth than any digging was ever carried. The cavern has long been a refuge for stock, and this, with the trampling of many visitors, has mingled all the superficial deposits, so that, while ashes may be seen mixed with the débris, no ash beds are now to be found.

There must be a very pronounced cavernous condition in this vicinity. At a number of places, even extending to a distance of 2 miles from Onyx Cave, the passage of a wagon produces a rumbling sound, indicative of a cavity at no great depth. There are also many sink holes, some closed, forming ponds, others with free openings. They are so numerous that no one of them drains any considerable area. The largest of these sinks measures from top to top of its slopes about three-fourths of a mile long and half a mile wide. Around much of its margin are vertical cliffs; there are few places where descent is practicable. It is 300 feet deep, perhaps more; for when the Gasconade, more than a mile away, is at flood stage the water from it, backing through an underground passage, breaks in at two different points not at the same elevation, and covers the nearly level floor of the depression, about 15 acres in area, to a depth of 15 to 20 feet.

Another sink, near this, is conical in form, a fourth of a mile across and more than 200 feet deep.

GOAT BLUFF CAVE (10)

Goat Bluff Cave, 4 miles west of Arlington, on the left bank of the Gasconade, is at the foot of a vertical cliff 50 feet high, the slope above rising about as much higher to the crest of the ridge. A few yards to the west is a slight ravine through which, with a little effort, the top of the hill may be reached. In front, the declivity, while steep as earth will lie, furnishes fairly easy passage to and from the river which lies 200 feet below.

The entrance to the cave is an arch 30 feet high and 75 feet wide, facing a little east of south. The width holds nearly the same for

90 feet, whence it rapidly contracts to 20 feet; the roof meanwhile descending to 10 feet above the floor. The extreme rear of this chamber is nearly filled with large blocks of stone. At the front part the floor is several feet higher along the west wall than at the east; this condition being due to the combined action of accumulation from the ravine above mentioned and erosion by a little rivulet which emerges from a crevice 30 feet within the entrance and flows at the foot of the east wall. Beyond this the floor is practically level across the inclosed space, with a slight and uniform ascent toward the rear. No evidence of rock bottom appears at any point.

A preliminary cut at the outer margin of the cave showed two distinct, sharply separated strata. The lower is a red or yellow clay containing much angular gravel such as usually results from disintegration of limestone in which chert is abundant. Above this is a deposit of very loose fine material. Toward the rear the upper deposit had been disturbed by "curiosity seekers," who reported finding much evidence of prehistoric occupation, such as ashes, charcoal, fragments of pottery, and worked flint, as well as several skeletons, the latter "in a sitting position." The last part of this statement is a mistake. The bodies were closely flexed and placed on the side; the bones settled to the bottom of the grave, while the skull, if intact, is reached first by excavators and the conclusion drawn at once that it is "on top of the other bones." This error of observation is quite common among relic hunters, and is not unknown among student investigators.

In order to dispose of material removed in excavating, it was necessary to start a trench from the slope outside the mouth of the cave. As it progressed the substratum of clay became wetter and more difficult to dig. At 40 feet from the beginning, where the trench was 11 feet deep, the seeping water accumulated until it covered the bottom of the trench, so that no greater depth could be reached. A crowbar forced downward for 18 inches, as far as it could be driven, did not reach solid bottom. Not the slightest trace of human agency was found anywhere below the top of the clay, and from this point excavations were confined to the upper stratum, to which alone the following description is applicable.

This deposit was composed partly of fine loose earth, probably carried in by the wind and on the feet of persons and animals; partly of roof dust; and partly of ashes. A considerable portion of it was roughly stratified in layers of varying extent and thickness, though much of it was irregular, and it was mingled throughout with camp-site débris. Occasional layers of roof dust several feet across in any direction and of varying thickness, from a faint streak to 6 inches, so closely resembled ashes that many persons could not be convinced of its true character. Its occurrence in this manner indicates that

during considerable periods the cave was unoccupied, or at most used only as a temporary refuge. The intermittent character of occupancy is also shown by the distinct segregation of numerous successive layers of kitchen refuse.

About 10 feet within the point where a vertical line from the front edge of the roof would meet the floor the skeleton of a very young infant was found above and in contact with two thick angular blocks of limestone weighing 300 to 400 pounds. These rested on the red clay and had fallen from the roof. The thickness of earth above the bones was about 3 feet.

Ten feet farther in, on the clay floor, under almost exactly 5 feet of undisturbed material, were five flat stones. Three were of sandstone, the largest about 25 pounds in weight, such as can be found in place only on top of the hill. They were carefully arranged for use as a fire bed; on and around them were potsherds, flint chips, animal and bird bones, and a bone awl. This was the greatest depth at which artificial objects were found; and their position shows them to be as ancient as anything discovered.

At 25 feet in an interesting find was made. Eighteen inches below the surface of the floor, in a mass of mingled charcoal, ashes, mussel shells, flint chips, and other aboriginal refuse, was a small piece of glass, apparently part of a bottle, shown in figure 5. Above it and extending for several feet on every side was an unbroken stratum of root dust from 2 to 4 inches thick. Above this, in turn, were several thin, undisturbed layers of camp refuse, about 6 inches in all, and then 6 inches of the loose, incoherent surface earth. This discovery is susceptible of two interpretations. One is that between the date when Indians could procure articles from the whites and the date at which they abandoned this fireplace there was time for the accumulation of the given thickness of disintegrated material from the roof, the cave, or at least this part of it, not being used meanwhile for a habitation; then for the accumulation of several distinct layers of camp refuse; and finally for the depositing of the cave earth over it all. This hypothesis is unreasonable. While the rate of formation of either roof dust or stalagmite is extremely variable, so that it is not safe to predicate a definite antiquity for objects found beneath even a considerable thickness of either, at the same time the small area involved precludes the idea that a number of occupants sufficient to account for the volume of débris could have lived here unless we allow a

FIG. 5.—Fragment of glass bottle from Goat Bluff Cave.

much longer period than would necessarily elapse within the dates indicated. The other, quite plausible, interpretation is that the glass was dragged to the spot by a ground hog or other animal whose runway had become obliterated by settling of the loose material through which it was made.

The only purpose of elaborating this subject is to guard investigators against attaching too much importance to an article found under such or similar conditions, whether it be a "palaeolithic type," or an "object undoubtedly of European origin."

Thirty-five feet in, under three flat slabs whose upper surface was a little more than 3 feet below the floor, was an adult skeleton, on the back, knees flexed to the chest. The body had been laid in a cavity dug in the clay to a depth of 6 inches. The bones were well preserved and fresh looking, but light and fragile.

Forty feet in, 3½ feet down, was a flat stone under which were two skulls. One, shown in plate 6, was perfect, with a full set of sound teeth; from the other, seen in plate 7, the lower jaw was missing. No other bones were found except two cervical vertebræ, belonging to the smaller skull. Undisturbed stratified ashes and roof dust were 30 inches thick above the stone.

To this point the trench was not dug to a greater width than 15 feet; it was now gradually extended to a width of 40 feet to include most of the central portion.

Sixty feet in, in the upper part of the clay, like all the human bones discovered, was a skull with the scapulæ, a few ribs, and one arm bone. The lower jaw was missing, and two phalanges were inside the skull. With the scapulæ was one of a much smaller person. Eighteen inches from these bones, and 6 inches higher, was part of a lower jaw.

At 50 to 60 feet in, on the clay stratum, lay a slab 10 to 12 feet across and of varying thickness up to 18 inches or more. It fell from the roof so long ago that the latter is worn and smoothed above it in much the same way as at other parts. At the east edge of this slab was a skull so soft and crushed that it could be taken out only in small fragments; the teeth were very slightly worn, though of large size. A few traces of other bones were found; not enough to identify. At the north edge of the slab were two skulls, one of which is shown in plate 8; the other, which belonged to a young person, is given in plate 9. The limb bones, scapulæ, and hip bones, with a few others, were in a small pile at one side; but neither lower jaw, no ribs, and only a few vertebræ were found.

About 65 feet in, near the west side, an inverted pot which shows no marks of use was found in a mass of ashes filling a cavity the size of a half bushel, which had been dug in the upper deposit. Scattered here and there among the ashes were also some mussel

a

b

SKULL FROM GOAT BLUFF CAVE, PHELPS COUNTY, MO.

a, Front; *b*, profile

a

b

SKULL FROM GOAT BLUFF CAVE

a, Front; *b*, profile

a

b

SKULL FROM GOAT BLUFF CAVE

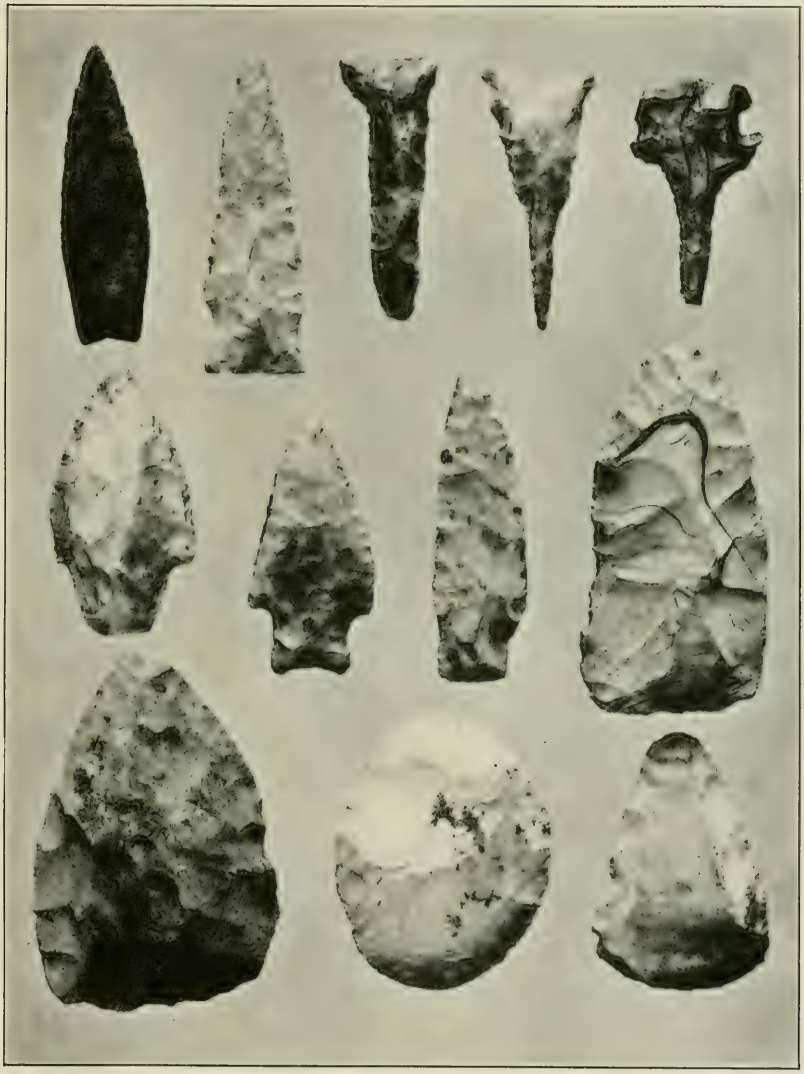
a, Front; *b*, profile

a

b

SKULL OF CHILD FROM GOAT BLUFF CAVE

a, Front; *b*, profile



FLINTS FROM GOAT BLUFF CAVE

BONE AND ANTLER IMPLEMENTS FROM GOAT BLUFF CAVE

BONE AND ANTLER IMPLEMENTS FROM GOAT BLUFF CAVE

a, Cairn six miles north of Arlington, Mo.

b, Walled grave six miles north of Arlington, Mo.

shells and broken deer bones; but the presence of these was probably not intentional, as the whole arrangement seemed to have the nature of a votive offering. This was the only perfect vessel found in the entire course of the explorations. It is of the ordinary "cocoanut form," and is represented in figure 6.

Seventy feet in was a skeleton, on the left side; the bones were soft and came out in small fragments. This was fully 6 feet below

FIG. 6.—Pot from Goat Bluff Cave.

the present surface, but some of this earth was piled up from earlier excavations.

Beyond this point the ground had been dug over to such an extent that further examination seemed useless, and the work was concluded.

Throughout the deposit of black earth, ashes, and roof dust were scattered irregularly arrowheads and knives of flint, some types of which are seen in plate 10; mussel shells; fragments of bones from food animals; bone perforators, some of which are shown in plates 11 and 12; potsherds; hammers; pestles; two or three mortars; a grooved stone ax of granitic rock, presented in figure 7; and an abundance of flint chips.

There is a small cave near the top of the bluff facing the Gasconade, a short distance above the mouth of Little Piney. Within a few yards of the entrance earth and rock carried in from a sink on top of the hill fill the cavity to the roof. Water runs through after every hard rain.

Three small cairns, built of small stones, stood on the point of the bluff at the junction of Little Piney and the Gasconade. All are destroyed.

On the edge of a high cliff over the Gasconade, 2 miles north of Arlington, are three cairns, destroyed.

In Bryant's Bluff, facing the Gasconade 3 miles below Jerome, are two rock shelters, neither of them more than 20 feet across in any direction. In both are shells, bones, and pottery; a rough stone hammer was found in one. Exposure of bedrock on the outside shows that the earth deposit in either is not over 2 or 3 feet deep.

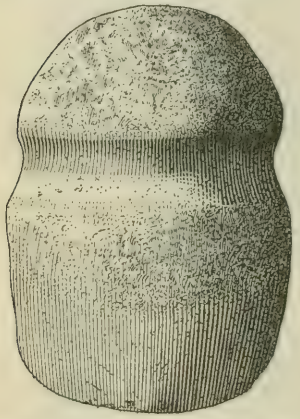


FIG. 7.—Grooved ax from Goat Bluff Cave.

On top of Bryant's Bluff are four cairns, all of them torn up. The extreme limit of the scattered stone is about 20 feet; so the cairns were probably 12 to 15 feet in diameter.

At the mouth of Turkey-pen Slough, 4 miles north of Arlington, is a terrace with steep banks on two sides, next to the river and to the slough. On this stood a village. Three house sites are plainly marked by the refuse around, and there may be others; vegetation is very dense. Mussel shells and burned stones are abundant, and many flint implements have been picked up.

CAIRNS AT SUGAR TREE CAMP (11)

Six miles north of Arlington is a clubhouse known as Sugar Tree Camp. A short distance from the building is a high vertical cliff rising almost directly from the Gasconade. The top of this cliff, near the front, is of solid rock, almost bare of timber or brush, and in a row along it close to the edge are seven cairns, all now so defaced that any attempt at investigation is useless. The smallest, at one end of the row, is of the common circular form, about 12 feet in diameter. Three others seem to be of the same type; but their appearance may be due to their destruction. One is shown in plate

13, *a*. The other three are walled vaults. The largest, at the other end of the row, was built up like a foundation wall of sandstone slabs. It is rectangular in form, measuring on the outside 16 by 28 feet. All the walls are more or less destroyed; the small portion of one remaining is shown in plate 13, *b*. Two "walled-up graves" reported on the first ridge north of Sugar Tree Camp, and one reported on the first ridge south, never existed. There is a small cairn on a high peak half a mile east of the camp.

TICK CREEK CAVE

In a ravine which joins Tick Creek about 2 miles from where the latter flows into the Gasconade, and about 12 miles north of Arlington, is a large cave known as the Saltpeter Cave.

The opening is wide and high, but the mouth and floor are much obstructed by large fallen rocks and the bottom is constantly wet from wall to wall with running and seeping water.

There is another entrance to this cavern around a corner of the bluff and much higher up on its face. This opening is small and the sloping passage from it to the cavern is almost closed in places by drip formation.

It was never inhabited.

CAVE IN POOL HOLLOW (12)

A mile east of Newburg a ravine now known as Pool Hollow, but formerly called "Strawhorn's" [Strawhan's] Hollow, opens into the right (north) side of Little Piney. Two miles from the river is a cave at the head of a little cove. The entrance, facing directly south and visible from half a mile down the ravine, is 12 feet high and 75 feet across. The rear wall, where the cave makes a turn at 150 feet from the mouth, is plainly visible from the outside.

At 60 feet within water reaches from wall to wall, and a constant stream flows along the left side. The talus at the mouth is of tough clay with many rocks scattered through it, and much of it has settled back into the cave. Water drips from many places in the roof, so that no part of the floor is ever entirely dry.

Some broken flints and chips were picked up about the mouth and in front of the cave, but nothing else could be found.

In dry weather there might be spots which would afford a resting place for campers, but no continuous occupancy was possible.

HOUSE MOUNDS NEAR ROLLA (13)

Nearly 2 miles northeast of Rolla is the beginning of a little valley which for a short distance is parallel with the Frisco Railway and close to the right of way; it then turns to the southward. Along

this "draw" are numerous mounds, starting well toward its upper end and following its course for nearly a mile. They lie along either side, and reach into the tributary widenings. Most of them are on the flats; but they are also scattered along the hillsides, those farthest from the water having an elevation of about 50 feet above it. They vary from 30 to 60 feet in diameter and from 1 to 3 feet high. In all, they are scattered over an area of at least 100 acres.

HOUSE MOUNDS NEAR DILLON

Half a mile west of Dillon a ravine heads at the Frisco track, goes south a short distance, then turns southeastward. Near the track begins a group of mounds which reach for fully a mile along both sides of the little stream.

There are more than 100, most of them small, though at least one is 60 feet across and 3 feet high.

HOUSE MOUNDS NEAR ST. JAMES (14)

At the northern border of St. James is a small shallow valley with a northern and eastern trend, practically parallel with the Frisco Railway, and for 3 miles or more not over a fourth of a mile from it at any point.

Starting near the Soldiers' Home is a group of mounds which extend for fully 2½ miles down both sides of the valley.

Some are partly cut away by the stream, others are on the narrow flat bottoms subject to overflow with every hard rain, still others are built on the slopes to an elevation of 40 feet. They are somewhat larger than the average, a diameter of about 60 feet and a height of 3 feet being not uncommon.

PULASKI COUNTY

MCWILLIAMS CAVE (15)

A cave on the McWilliams farm, near Jack Hinshaw's, at the upper end of the Big Eddy, near the south line of Pulaski County, has an entrance 8 feet high and 15 feet wide. There is a good light for 150 feet, at which distance the cavern turns. It is an excellent location for an Indian home, having a floor of dry earth, and a small amount of refuse was found; but the earth has been thoroughly dug over in the search for missing residents, some human bones rooted out by hogs having given rise to a belief that these may have been murdered and concealed here.

DAVIS CAVES (15)

Facing Roubidoux Creek, on the farm of J. W. Davis, 3 miles north of Cookville, are three caves. The largest is 40 or 50 feet

above the foot of the bluff. It has an entrance 30 feet wide, the roof being 8 feet high. It is well lighted to a depth of 120 feet, where it curves. No refuse was observed, but the situation is favorable for habitation.

Another cave, near this, has an entrance 30 feet wide and 10 feet high; it is well lighted for 40 feet back.

The third cave of this series is a rock shelter a short distance south of the second, and higher up in the bluff.

All these appear to deserve an examination.

BERRY CAVE

A cave on George Berry's land, in a ravine opening into the east side of Roubidoux Creek, 3 miles from Hanna post office, has a small entrance which is nearly closed by "drip rock," the roof, walls, and floor being thickly incrusted. These deposits, which it is said are even more abundant farther in, seem to be rather rapidly increasing in volume.

MAXEY CAVE (16)

What is known as Maxey's Cave is 7 miles south of Waynesville, on the west side of Roubidoux Creek. It is by far the largest open cave in this region, the entrance being 40 feet high and 100 feet wide. It extends across the head of a ravine, and if the loose earth at the sides were cleared away it would be found still wider. The entire floor is covered with a mass of rocks of every size up to several tons, except at one side of the entrance where there is a small amount of loose earth. The front chamber is 300 feet long to where the cavern forks; in one of these forks daylight extends for 100 feet farther, or 400 feet from the mouth. Marks on the walls show that the entire floor is sometimes covered 2 or 3 feet deep with running water.

A survey made some years ago disclosed a mass of earth and rock "a long ways back in the hill;" definite figures could not be obtained. Beyond this point it was impossible to proceed. By running corresponding angles and lines on the surface outside the surveyors came to a very large sink hole, into which flowed the drainage of several farms. This explains the flood marks. Clearly the roof of the cave had fallen in at this point.

YOARK CAVE

Yoark Cave, a fourth of a mile east from Maxey's in a bluff facing south on the left bank of Roubidoux Creek, has an entrance 40 feet wide, 30 feet high, and is in daylight for 150 feet. Cave earth extends for 100 feet from the entrance, and apparently continues from this point under the gravel and clay which have washed from the interior.

It is on the land of A. L. Foote, having been in his family continuously since it was secured by Government patent. The name is derived from "Grandma Martha Yoark," who was among the earliest white settlers in the region. Her home was on the opposite side of the creek, in a pioneer log cabin, the last vestige of which, except the stones of the chimney, disappeared before the Civil War.

In the front portion many large rocks are lying on the surface of the clay floor and others are imbedded in it; probably still others are entirely covered. Farther back the clay is mixed with gravel washed from the interior. This deposit is never entirely dry and in rainy seasons is quite muddy. The difficulty of removing or digging under the rocks, added to the certainty that water would be encountered before the bottom is reached, render useless any effort at complete excavation. The amount of refuse on the surface, however, is a good indication that such researches as would be possible in the upper layers, among the rocks, would disclose a large quantity of aboriginal remains of comparatively modern date.

GRAVES AT LAUGHLIN'S (17)

On the Laughlin goat ranch, 6 miles southeast of Waynesville, a high narrow ridge level along the top and sloping abruptly on each side extends northward from the hills on the right side of Roubidoux Creek and terminates in a vertical cliff. Bedrock projects on the top and on both sides, and vegetation is so scanty that the crest is almost a "bald."

On the summit of this ridge are seven cairns, the first one only a few feet from the edge of the cliff, the last one about 300 feet back, near where the ground begins to ascend toward the plateau. They are small, none more than 3 feet high, and all have a depression in the top where the stones have been thrown out from the center toward the outside by relic seekers and rabbit hunters.

In three of them flat stones remaining in place at parts of the margin indicate that an irregular square inclosure was constructed around the bodies, as in those examined at Gourd Creek. Possibly this feature existed in all of them at the time of their construction, but there was no evidence that any of them had been walled up like those at Sugar Tree Camp or the Devil's Elbow. Views of their present conditions are shown in plate 14.

KERR CAVE (17)

Near the site of Kerr's Mill, on Roubidoux Creek, 5 miles southeast of Waynesville, is a cave at the foot of a bluff, the entrance 60 feet above the bottom of the hill. Viewed from the outside it has the appearance of a rock shelter 40 feet wide and 45 feet deep. Above

most of it the stratum forming the roof is 15 feet high; near the front the successive overlying strata project in a hollow curve until at the face of the bluff the drop from the ledge to the talus immediately beneath it is fully 50 feet.

At one side, near the rear, is a passage 5 or 6 feet wide, not visible from the front, extending back into the hill. Although the cave is usually dry, clean gravel in this passage shows that sufficient water flows through at times to prevent earth from accumulating; further evidence of which fact is found in the mud cracks of the floor and the ferns growing amid the rocks, large and small, which cover it.

The place could never have been occupied except for temporary shelter, and there is no evidence that even this use was made of it.

SELL CAVE (18)

Half a mile directly south of Waynesville, on the farm of Dr. W. J. Sell, is a cave located in the northern end of a ridge entirely detached from the surrounding hills. The entrance, facing northeast, is halfway up the point of the ridge, overlooking a fertile bottom along Roubidoux Creek. From the top of the ledge over the entrance the hill has an easy upgrade for a fourth of a mile to the summit, which is at an elevation of 250 feet above the creek. On top of the hill is the site of an Indian village where some mortars, grinding stones, and numerous flints have been found.

The roof of the cave has partially fallen in at the entrance, forming a re-entrant curve 30 feet across and extending 11 feet inward; the large blocks from this, and from the stratum described later, were lying on and in the talus at the present front but did not extend to the red clay beneath. Some of the blocks could be reduced with a heavy sledge hammer to an extent that made it possible to roll them out of the way; but 24 of them had to be broken up with dynamite.

The talus at its thickest part has a depth of 6 feet; it extends down the hill on the outside and has washed back into the cave, gradually decreasing in quantity, to a distance of 50 feet. The roof, at the front, is 5 feet above the talus; the thickness of the ledge forming it is only 8 feet, the slope of the hill starting from this line. Owing to the restricted width of the ridge, on top, the entire area draining over the ledge measures only 70 feet in width above the entrance, and narrows irregularly to a breadth of 30 feet at an outcrop 120 feet up the hill, or with an approximate space of 6,000 square feet. On this small tract more than half the rock is bare, with scanty patches of soil and humus in the crevices and on flat places. At the present time the water which flows over the ledge during hard rains is scarcely turbid; consequently a period of several centuries was required for the débris to accumulate.

Fourteen feet back from the farthest-receding part of the curve of the roof at the front is the edge of a stratum 3 feet thick; the bottom of this was 3 feet above the talus immediately beneath it. This stratum is continuous, with a perceptible dip to the interior, as far as it can be seen.

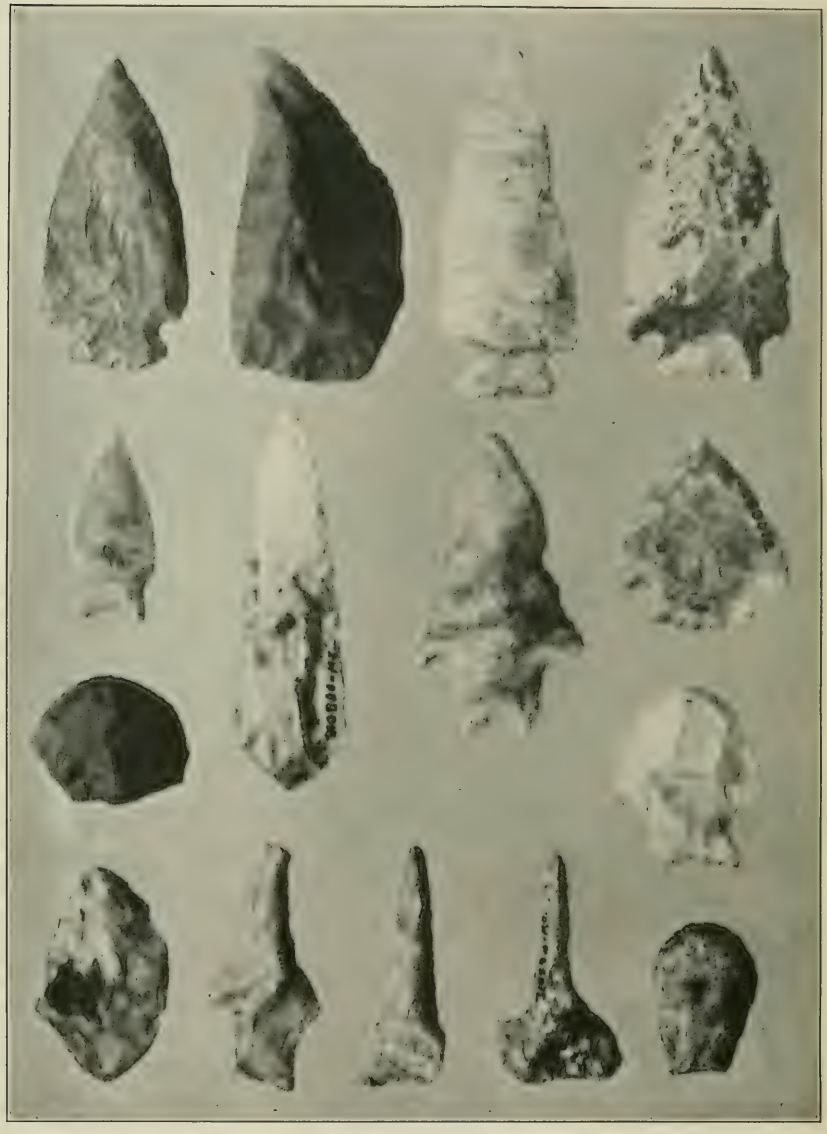
The width of the cave at the mouth is 44 feet; 30 feet within it widens to 51 feet. A small amount of water making its way from the interior over the level floor collects in a little basin scooped out to receive it, and sinks into the floor near the inner foot of the talus 55 feet from the entrance. At this point the width of the cave is 36 feet; the height to the roof is 4½ feet. As the floor beyond here is soft mud, the cavern was not followed farther.

Owing to the limited space between the floor and the roof it was necessary to remove the excavated earth to the outside. The water which flows from the hill and falls upon the talus during rains also had to be provided against. A trench 4 feet wide at the bottom, with sufficient slant to the sides to prevent them from falling in, was started 25 feet out from the entrance, on a level which gave it a depth of 6½ feet at the highest point of the talus, thus carrying it a few inches into the clay which was the original floor of the cave. This depth also brought it well below the level of the little pool inside. When its greatest depth was reached the excavation was at once widened to 25 feet, thus reaching well toward the cliff on either side. Growing trees and large rocks made a greater width here impracticable.

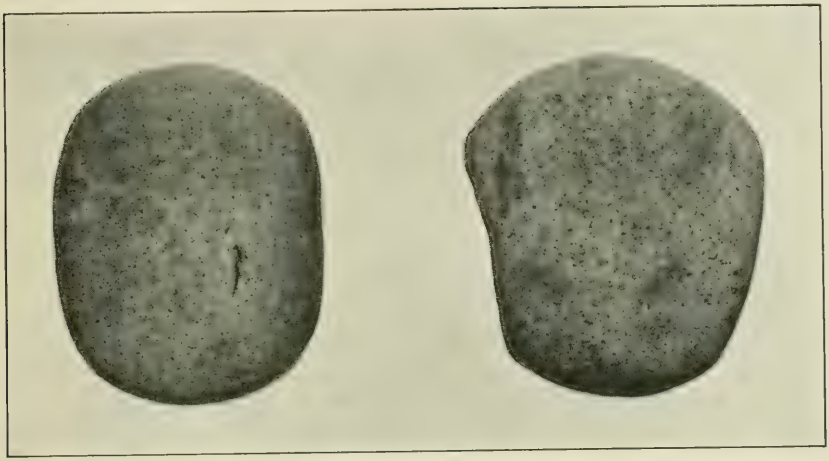
In the talus were flint implements, none small enough for arrowheads, some well finished, others roughly made, a few being shown in plate 15; three sandstone mortars and fragments of four others; probably 100 cobblestones used as hammers and pestles, some of them pitted on the sides, a few showing marks of much use (pl. 16, *A*); a small, very solid piece of hematite worn round by use as a hammer; a small, imperfect tomahawk made of quartzite (pl. 16, *B*, *a*); many mussel shells, some used as knives and scrapers; animal bones, some of them worked into implements, including a perfect skiver (pl. 16, *B*, *b*); several pieces of hematite and limonite used as paint stones (pl. 16, *B*, *c*); many fragments of pottery, some of them worked into disks and perforated (pl. 16, *B*, *d*); occasionally small deposits of charcoal, ashes, and burned earth. The meager amount of artificial material, and its random distribution, as if one piece was lost here, another thrown there, throughout the talus from the present surface to the underlying clay would appear good evidence that the cave was never used as a place of permanent abode, but merely provided temporary refuge at intervals extending over a prolonged period.

None of the pottery was decorated in any way, though most of it was cord-marked; no piece was found which had a handle or a

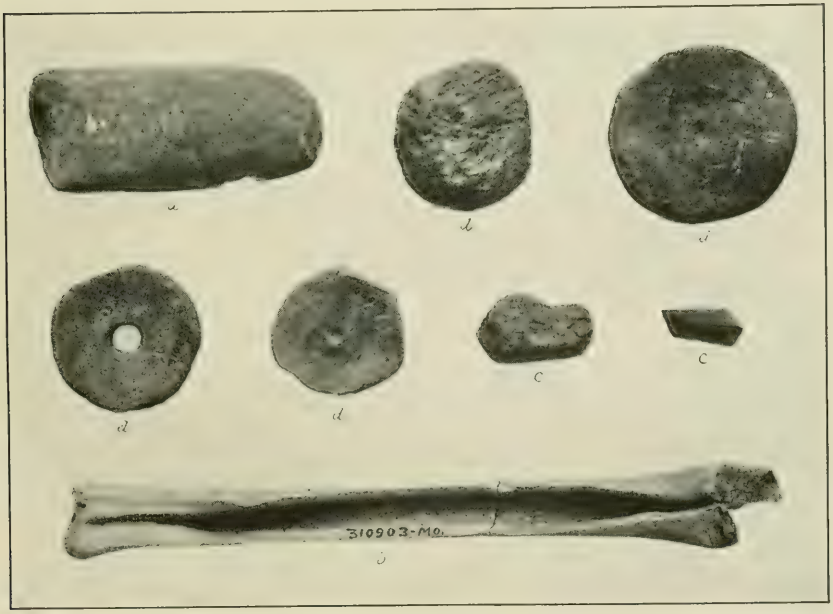
CAIRNS ON ROUBIDOUX CREEK, SIX MILES FROM WAYNESVILLE, MO.



FLINTS FROM SELL CAVE, NEAR WAYNESVILLE, MO.



A, Pestles or grinding stones



B, Celt, pottery disks, paint stones, and skiver

OBJECTS FROM SELL CAVE

a

b

Skull from Sell cave. *a*, Front; *b*, profile

c

d

Skull from Bell's cave, near Waynesville. *c*, Front; *d*, profile

e

f

Skull from Miller's cave. *e*, Front; *f*, profile

THREE SKULLS FROM PULASKI COUNTY, MO.

foot. Nearly half a bushel of pieces was found, fragments of many different vessels, with a range in thickness from one-eighth to three-fourths of an inch.

If all this talus were examined, much material might be found, but the result would not justify the labor.

Fifteen feet west from the east corner of the cave, 8 feet within the edge of the roof, 3½ feet under the surface of the débris, which was a foot lower here than at the highest point, was a bundled or bunched skeleton; only small fragments of arm and leg bones, most of the lower jaw, a little of the upper jaw, and traces of skull were remaining. The bones were small but solid. They were packed tightly in the dark, wax-like clay, but there were no indications of a grave; the earth in contact with them could not be distinguished from that lying around them. The body had been crowded into the smallest possible space, with the head against a large stone. All the teeth were well preserved, some of them not at all worn. Small fragments of deer bones were found among the remains; these, also, were very soft and decayed.

In fact, all bones found, whether human or other, in this wet, tough, heavy earth were nearly destroyed, and such portions as remained had but little more consistency than the mud in which they were imbedded. Much care was necessary in order to get them out.

Sixteen feet from the entrance, 13 feet from the east wall, 4½ feet down, 18 inches above bottom, were part of a large femur and a few fragments of other bones too small and crushed to identify.

Seven feet southwest of this femur, 14 inches lower, was a closely folded skeleton, the skull nearly north, the other bones toward the east wall. Some mussel shells, fragments of deer bones, and two flint knives were near the head. The body had been placed in a shallow hole dug in the talus as it existed at that time, some earth thrown over it, and small rocks piled on. The covering rocks were under 3 feet of detritus, washed in since they were placed there. Near the knees was a piece of antler, neatly perforated, with rounded ends, giving it the shape of a reniform bannerstone (fig. 8). This may have been an ornament, an arrow-shaft straightener, or the holder for a drill or a fire-stick. Near it was a polishing stone deeply worn on both sides (fig. 9).

Twenty-two feet within the reentrant curve at the front, 20 feet from the west wall, at the bottom of the talus, was a skeleton, the skull in small fragments, which, however, were held in place by the tough clay. The teeth were worn below the enamel in places; two well-worked flint knives and one rough one (fig. 10) were near it. The bones looked as if they had been thrown in, occupying only a small space; but probably a folded body had been laid in on the left side.

At 24 feet from the entrance, 17 feet from the west wall, in a hole dug to 20 inches below the present surface of the talus, were broken and spongy bones of an adult. Pelvis, feet, and leg bones were in confusion; the tibiæ were reversed in position, but it may be that the body was laid on the back with the knees flexed and that the bones had fallen as they were found. This is probable, as each patella was where it belonged, and the body lay extended toward the southeast, as shown by the position of the skull. The humerus was about 12 inches long; all the bones were in small pieces. There were many mussel shells among and above the remains, over which earth and small rocks had been piled.

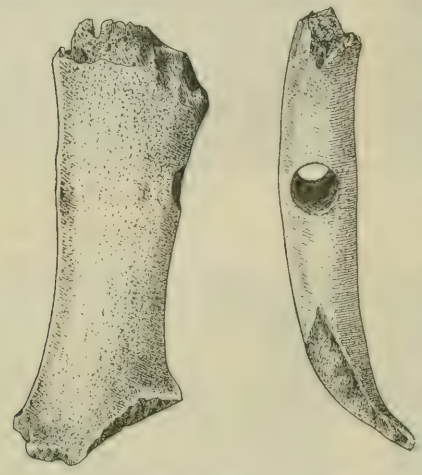


FIG. 8.—Perforated object of antler from Sell Cave.

Two feet south of this skeleton and a few inches lower were the crushed and decayed bones of an old person with the head lying toward the east. The one tooth found (a molar) was worn entirely below the enamel except for a small space at the front; the dentine was polished until it resembled a piece of agate. Mr. De Lancey Gill first remarked the fact that wear of this character denotes that the individual did not gnaw bones, crack nuts, or indeed bite hard on any substance. If he had done so this thin shred of enamel would have broken off. Two large rocks which lay on the head and body seem to have been thus placed before the grave was filled with earth.

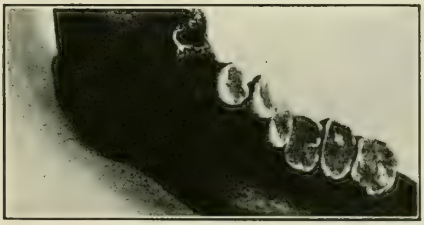
Near these bones were fragments indicating three other interments; the humerus of the last was perforated.

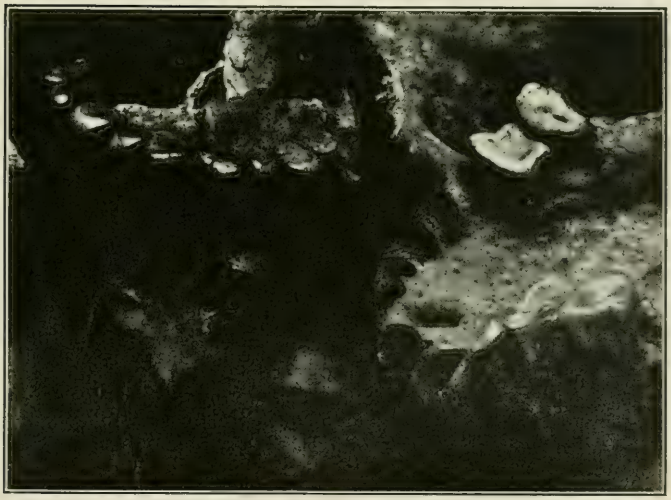
Other arm bones found showed the same olecranal perforation.

FIG. 9.—Rubbing or polishing stone from Sell Cave.

Twenty-one feet from the entrance, 19 feet from the east wall, was a skeleton, closely folded, on left side, head toward rear of cave. The teeth were worn flat. The bones were crushed by rocks laid on or above the body at the time of burial, as was the case with all the skeletons found in this part of the cave; probably timbers had been interposed.

Near the surface, 18 feet from the entrance, 14 feet from the east wall, were the right half of a skull and of a lower jaw; a few small, scattered pieces of skull were found near them. The teeth were





TEETH FROM SELL CAVE AND OTHER CAVES, SHOWING MANNER AND AMOUNT OF WEAR

TEETH FROM SELL CAVE AND OTHER CAVES, SHOWING MANNER AND AMOUNT OF WEAR

much worn, some of them were decayed, and two had the roots swollen and distorted by ulceration. South of the skull were fragments of feet and leg bones, probably belonging with it. This interment was of much later date than the others.

Thirty-two feet from the front, 16 feet from the east wall, 2½ feet below the surface, and a foot above the bottom of the talus, was a folded skeleton, on left side, head toward the interior of the cave, face directly upward. So much of the skull as could be recovered is shown in plate 17, *a*, *b*. The teeth were much worn, the bones

FIG. 10.—Flints from Sell Cave.

broken, soft and spongy, falling away with the clay as it was removed from about them. The femur was about 17½ inches long.

Wear of teeth among aboriginal people does not of necessity denote a great age for the individual. Grit from ashes and fine sand from mortars and pestles will cut away the enamel to a much greater extent than would result from the use of ordinary food.

The condition of the teeth mentioned, as well as of some from other localities, is shown in plates 18 and 19.

From the inner end of the ditch, or runway, at the entrance the excavation was carried back for 40 feet in a direct line; or making allowance for passing around a massive rock which was in a position where it could not be blasted, for 43 feet; the depth of the talus here was 3 feet.

On the east side the talus was removed to the wall, a distance of 28 feet from the edge of the trench, and the wall rock exposed for 22 feet, to the rear bank of the excavation.

All work, so far, had been carried on at a level a few inches below the bottom of the talus, which rested directly upon the floor of clay washed out from the interior of the cave.

Beginning next at the outer end of the trench, the entire space included in the first excavation was deepened by a little more than 6 feet, giving a new floor about 13 feet lower than the highest part of the talus. All the material thus removed showed that it was laid down by flowing water, sometimes so quiet as to deposit clay of impalpable fineness, sometimes with a velocity sufficient to carry stones weighing 3 or 4 pounds. The material varied—red clay, now jointed, was the topmost layer; below it, in patches and layers, were dark earth, resembling soil; clay of different shades of yellow, brown, red, and gray, sometimes almost blue; some of it uniform, some of it mingled, one or any or all of the different sorts in small compass; deposits of one sort filling sharply defined channels or potholes cut in some other sort; occasionally there was a slight admixture of sand. All included limestone pebbles, which were plentiful in some deposits but entirely absent from others, were weathered to a chalky consistency, the larger ones to a depth of perhaps half an inch, the smaller ones throughout. Scarcely any chert was included, although it is abundant on the hill; the few pieces seen were very small.

It took five weeks of steady work, with two men, to clear out the second level. In all this clay there was not the slightest trace of bone or other indication that living beings of any kind had existed either in the cave or in any place from which the clay had come.

At 24 feet from the eastern side of the trench, projections on the face of the east wall denoted that bed rock was not far away. A hole 8 feet across, at the rear of the excavation, reached sand with a slight admixture of clay a few inches under the level at which the work was being conducted; and 4 feet down, or 17 feet from the top of the talus, the rock was found. It was rough and furrowed, like a solid stratum that has been long exposed to atmospheric weathering.

Further exploration was useless. The sand results from disintegration of the Roubidoux sandstone belonging next above the limestone in which the cave was formed. None of this remains on the hill; it has all been carried away by erosion. There is not now any sink hole or crevice above the level of the cavern through which the sand could have made its way. Such an opening must have existed at one time, on the slope at one side or the other, or farther back where the hill is now cut off. In either case, erosion has carried

away its walls and filled up the channel leading from it, and thus obliterated its site. To accomplish this would require a long time; enough to produce a considerable alteration in the topography, and so to predicate for the bottom deposits in the cave an antiquity far beyond the possible appearance of man in the region.

PHILLIPS CAVE

The Phillips Cave faces Roubidoux Creek near the Big Spring, a mile south of Waynesville. Access to the interior is possible only by crawling some distance on wet clay. Other caves in the same line of bluffs are either very small or almost inaccessible. No refuse appears about any of them.

BELL'S CAVE (18)

In the upper part of the bluff bordering Roubidoux Creek just west of Waynesville, on the farm of Robert A. Bell, are numerous caves, most of them quite small. One, much larger than any of the others, has an entrance 27 feet wide and 12 feet high. The floor is of earth mingled with small rocks, and rises gradually toward the rear until at 70 feet it almost reaches the roof, although the open space enlarges farther in. The width of the cave varies from 19 to 32 feet. Several large rocks have fallen from the roof and walls at a comparatively recent date, as they lie directly upon the earth or are only slightly imbedded in it.

Shells and flint flakes occur in small amount, but the cave is so difficult of access that it was probably but little used.

Some human bones, rooted out by hogs, were scattered over the floor; only a few remained, the hogs having chewed up most of them. Part of a femur belonged to a person about 18 or 20 years of age. A skull and part of a lower jaw, lying several feet apart but belonging to the same individual, were secured; they are shown in plate 17, *c*, *d*. Few of the teeth remained, though all had been in place at the time of interment.

CAMP-GROUND CAVE

This is three-fourths of a mile west from Waynesville. It is small, with a muddy bottom, and could never have been occupied.

BUCHER CAVE

Bucher Cave is 2 miles northeast of Waynesville. It has a small, low entrance, nearly closed by a pile of chert gravel mixed with some clay, which has been carried by surface water from the slope above.

GRAVES NEAR MCKENNAN'S

On a low spur, projecting about halfway up a high hill opposite McKennan's house, 2½ miles northeast of Waynesville, are two of the ordinary stone graves or cairns, both small. One has been torn apart; the other is intact.

They are mentioned only because in the one which has not been disturbed the stones are sunken at the center, affording good evidence that timbers were placed over the corpse before the stones were piled up.

ROUBIDOUX CAVE (19)

In a vertical bluff overlooking the junction of Roubidoux Creek and the Gasconade River is a cavern with a high, wide entrance giving access to a large chamber which has several smaller but well-lighted rooms opening into it. There was formerly a considerable depth of earth on the rock bottom, but most of it has been taken out for fertilizer. What is left is dry near the entrance, but wet farther in. Although it would make an ideal Indian home, being easy of access and within a few rods of the two streams, there could be found no indications of such habitation; and owing to the small amount of earth remaining, the presence of many large rocks, and the close proximity of a large club house on the public highway immediately in front, no excavation is possible.

A cairn on the point of the cliff over this cave has been completely demolished.

RICHLAND CAVE (20)

There is a large cave at the head of a ravine a fourth of a mile below the bridge over the Gasconade River, on the Richland and Hanna road, 7½ miles from Richland. The entrance is 70 feet wide and 40 feet high; daylight extends to a point 200 feet within, where the cave divides into two parts, both of which turn abruptly. Cave earth near the entrance on one side is scanty in quantity, damp and moldy; but beyond this it is dry, unevenly surfaced, and appears to have been somewhat disturbed. There is considerable refuse on and in the dry earth as far back as the inner end of the front chamber, and were it not for the many rocks, too large to be removed, which cover nearly the entire floor and would make excavation very difficult and incomplete, the deposits would probably repay investigation.

ROLLINS CAVES (19)

On the farm of Sam T. Rollins, 2½ miles northwest of Waynesville, are two large caves.

The first, in a bluff facing the Gasconade, half a mile above the mouth of Roubidoux Creek, is 50 feet above the bottom of the hill. The entrance, toward the northeast, is 45 feet wide and 36 feet high. The sides are parallel for 45 feet; at that point the east wall abruptly recedes for 12 feet and then continues in a curving line for 120 feet farther, to an outlet in the side of a shallow ravine trending toward the west. This opening, 13 feet wide, is filled nearly to the top with débris which slopes steeply for 40 feet into the cave.

The west wall, at 45 feet, makes an outward curve to a branch which leads northwest for 25 feet and has an opening on the side of the hill 25 feet wide and 20 feet high; the talus at the front is 12 feet high and slopes steeply into the cave. Beyond this branch the west wall extends in a straight line to the small outlet at the ravine.

The floor of the cave has a gentle incline from the bottom of the débris in the rear to the main entrance.

No refuse could be found in the cave or around any of the three entrances; and the place would not be suitable for a shelter in winter as the wind, no matter from what direction, blows directly through it.

The second cave is near the foot of the hill, half a mile up the river from the first. A gentle slope in front leads to the bottom land along the stream. The entrance, toward the northwest, is 60 feet wide and 10 feet high. At 65 feet within is standing water; marks in a channel along the west wall show that at times there is an outflow with a depth of a foot or more. At the front is a great amount of talus partly fallen from the ledge forming the roof, partly washed down from the hillside; the outer slope is 20 feet high, the inner slope has a slight incline to the standing water. The entire deposit within the cave and in front of it is of tough, sticky clay. Many large rocks lie on the surface or slightly imbedded, and large trees grow on the talus. No indications of occupancy could be discovered.

MIX CAVE (21)

On the Mix farm, half a mile below the Gasconade bridge on the Waynesville and Crocker road, on the left (west) side, at the head of a ravine, is a cave with an entrance 75 feet wide and 20 feet high. Cave earth, apparently not more than 3 feet thick at any point, although it gradually rises to a level 6 feet higher than the floor at the mouth, extends back 80 feet; beyond this is water-soaked clay and gravel reaching 60 feet farther to a turn in the cave, making a distance of about 140 feet in daylight. There is a shallow channel 12 feet wide along the east wall from the gravel to the entrance; evidence that at times a volume of water of that width flows out of the cave. The cave earth is damp for several feet from the line of

its contact with the clay, a certain indication that its lower portion is saturated.

Much refuse, including several mortars, is distributed over the floor, and it is especially apparent in the bed of the little stream; but fully half the surface is covered with rocks too large to be removed, and these, together with the water, will effectually prevent satisfactory excavation.

One of the mortars has a grinding cavity on one face 12 by 20 inches and 3 inches deep at the middle; on the other face, which has been pecked, apparently with a flint tool, to make it level and even, is also a cavity, but it is small and shallow, showing that this side of the stone was but little used.

DOUBLE CAVE (21)

On Walter Miller's farm, 1½ miles below the Crocker and Waynesville bridge, on the left side of the river, is the "Double Cave," so called for the reason that it has two entrances. The one farthest down the river is more nearly in line with the general trend of the cavern. Its opening is 35 feet wide and 20 feet high. At 40 feet in from the mouth, on the left or up-river side, the two parts of the cavern unite, a triangular partition of the original limestone strata separating them up to the point of junction. Across the apex of the triangle the main cave is 50 feet wide; there is no vertical wall on the right (east) side along this portion, the roof sloping down gradually until it meets the earth floor; it may extend farther, making the cave that much wider at the bedrock bottom. The cave earth at its highest point is fully 10 feet higher than at the entrance; but this may not mean that it is 10 feet deeper, for there are indications that the rock floor also rises from the entrance toward the interior. Digging in the front part of the main cave—that is, in the portion behind the lower entrance—would be impracticable owing to the huge rocks, some of them lying on the floor, others deeply imbedded in the earth; consequently part of them, at least, fell while the cave was inhabited.

From the junction of the two branches the cave earth extends back 60 feet to clay and gravel washed down from the interior; there is ample light at this point, and for some distance beyond. In part, this gravel seems to overlie the loose earth; it is still depositing, and the manner in which the various materials intermingle and overlap at their meeting place indicates that the cave earth to some extent underlies the gravel and clay. This feature is worth investigating, as it might have a bearing upon the relative age of the cave deposits.

The entrance to the branch cave is 20 feet higher in the face of the bluff than that of the main cave, and consequently much above any water flowing from the interior; it is 20 feet wide by 15 feet high.

Measured along the east wall, it is 40 feet from this entrance to the apex of the triangle separating the two parts of the cavern. The greatest width of the united caves, 70 feet, is just beyond this point. The earth floor in the branch, a fine-grained yellow earth apparently deposited by quiet or gently flowing water, is 3 feet higher than it is at the highest point farther back in the cave, and is 4 feet or more higher than the bedrock at the front. No direct communication is possible, in front, from one entrance to the other. The only means of transference is by passing through the caverns around the triangular partition, or by going down to the talus from one opening and then up to the other; though only a few feet of descent is necessary. There is an easy passage to and from the Gasconade, which flows at the foot of the bluff; and a good path in either direction to the top of the hill.

Very little refuse occurs, and the site is not worth examining.

RAILROAD CAVE

On railway property, north of the Gasconade River on the east of the Waynesville and Crocker road, is a noted cave which "runs clear through the hill," and can be entered from either end. From the descriptions given it certainly could never have been utilized as a dwelling place.

BAT, OR PAGE, CAVE

Bat Cave, so named because it formerly harbored immense numbers of bats, is on Robert Page's land, 4½ miles from Crocker, near the Waynesville road. The entrance is 40 feet wide and 30 feet high. Cave earth extends for more than 200 feet in plain daylight; at this depth the cave separates into two branches, one directly over the other. The lower division continues into the hill on a level; the upper rises at a slight angle; neither is high enough to permit a man to stand erect.

The greatest width, a few rods from the front, is 55 feet. A drainage channel near one wall shows a considerable outflow in wet weather. In the low, vertical bank of this drain, gravel and small rocks are mingled with the earth in such quantity as to comprise more than half the mass. But this is probably due to the fact that a large quantity of earth, mostly, of course, from the upper part of the deposists, has been taken away for fertilizer. Neither in the bank of the little channel nor about the pits left by this digging is any refuse to be seen, and there is none about the entrance. So, in spite of its suitability for residential purposes and its favorable situation, it does not seem ever to have been utilized.

TUNNEL CAVE (22)

A fourth of a mile from the Bat Cave is a natural tunnel or underground passage which has its beginning in a deep sink hole half a mile away on the farther side of the hill. Into this depression pours all the water that comes through a ravine more than 4 miles long, receiving several tributaries on the way; thus draining several hundred acres of steep hillsides from which storm water runs off almost as quickly as from a roof. From the sink hole it passes into the upper end of the tunnel, an opening 10 feet high and 20 feet wide. Trash and drift around this inlet show that the water rises above its top.

The lower opening of the tunnel is a beautiful, regular arch, 100 feet wide and 50 feet high. For some distance in, the interior is so choked with huge rocks, which reach almost to the roof near one side at the front, that it resembles a great quarry. Gravel, sand, and driftwood, including a large log 15 feet long, are piled on these rocks to a height of 20 feet.

BROOKS CAVE

Brooks Cave, 11 miles southeast of Waynesville, has an entrance through a sink hole in a level field. It is small and dark for some distance back, and was never occupied.

Openings of this character are never the original mouths of caverns; they are due to the roof falling in at a point where it has become thin by wearing away from below.

RIDDLE CAVE

Riddle Cave is on John W. Schord's farm, near Wildwood. The entrance is through a sink, similar to that at Brooks Cave, and is due to the same causes. It could never have been occupied.

LANE'S CAVE

Somewhat more than a mile north of Big Piney post office is a cave known as Lane's Cave. Near it is a smaller cave; also a rock shelter. They are all small, high up in the cliff, hard to reach, and unsuitable for living in.

DRY CREEK CAVE

A cave on Dry Creek, north of Lane's Cave, is small and almost inaccessible. Never used.

HOUSE MOUNDS (23)

There is a group of house mounds, about 100 in number, close to the site of the "Ranch House," which formerly stood near "The

Falls" 4 miles southwest from Big Piney. Two other groups, north of this one, carry the mounds for about 4 miles along a little valley, which extends north and south about midway between Big Piney and Bloodland. Most of the mounds, in all the groups, are on the slight slopes bordering either side of the little stream—which sometimes ceases to flow—but a few of them are on the narrow strip of level land along the banks.

There is another group south of Bloodland. They were not learned of in time to visit them.

RIDEN'S CAVE

A mile southeast of the steel bridge across Big Piney, on the Edenville road, is Riden's Cave, in a small ravine opening into another ravine. The entrance is 25 feet wide and 8 feet high, and the front chamber extends 30 feet to an abrupt turn. There are large rocks on the floor near the mouth and some cave earth and a small amount of refuse at the front. Apparently it was never occupied except as a temporary camp.

SALTPETER CAVE

Near Miller's Spring, 2½ miles northeast of Big Piney, in a high bluff, is a large cave whose name is derived from the quantity of saltpeter collected from it in the early settlement of the country. Earth for leaching was removed to such an extent that bedrock is now exposed near the entrance and at several places within. In addition many large rocks cumber the floor, consequently excavations would not yield satisfactory results, although refuse still to be seen in the cave and in front of it shows that it was a place of aboriginal habitation.

MILLER'S CAVE (24)

Three miles northeast of Big Piney is a cavern which from its position, formation, and surroundings is particularly adapted to the requirements of primitive people in search of a permanent shelter. It is situated in a bluff rising from the left bank of Big Piney River, 200 feet above the level of that stream and half that distance below the summit of the hill of which the bluff forms the front. It lies in three different tracts of land, but the greater portion is on the farm of Daniel S. Miller, who lives a little more than half a mile away. For three generations it has been widely known as "Miller's Cave." It opens toward the southeast, the river at this point flowing north of east, and thus secures protection from the cold winds of winter, receives the greatest amount of light

through the day, and has the advantage of sunshine at the season when this is most needed. Big Piney, like all streams in the Ozark region, is extremely crooked and its bed is a continuous succession of riffles and pools, or eddies as they are locally known. In front of the cave is one of these pools nearly a mile long and at lowest stages fully 15 feet deep in places; even now it yields an abundance of fish, turtles, frogs, and mussels, all of which are important items in the aboriginal dietary.

A fourth of a mile above the cave Big Piney makes an abrupt turn, coming to this point from the southeast. Here it receives the outflow from a large spring located at the foot of the hill, a fourth of a mile to the southward, which boils up in a pool 40 feet across and at its lowest stage discharges several thousand gallons every hour. Its volume responds quickly to a heavy rainfall and to the succeeding period of fair weather, although its level never passes above or below certain fixed points. A singular feature of this spring, one which has given it a wide reputation, is its rhythmic ebb and flow. With absolute regularity, regardless of atmospheric conditions, it swells for six hours, then subsides for an equal period, stages of high and low water occurring at the same hours every day. The extreme range of level is about a foot. Intermittent springs are not uncommon; but the regularity of this one is remarkable, particularly so as its action is not affected by changes in the volume. A dam was built below this spring by the father of Mr. Miller to furnish power for a mill; when the mill was not running the noise of the falling water, reenforced by the echoes from the hills around, could be heard a long distance and gave it the title of Roaring Spring. The Indians had a name for it which was interpreted by the whites as "Blowing Spring;" but as there are no unusual currents of air in the vicinity it is probable the proper translation would be "Breathing Spring," on account of its recurrent motion. The branch from this spring, following a course along the foot of the hill, is wide and shallow, though swift, and is nearly filled with a dense growth of long, moss-like vegetation which was greedily devoured by deer, herds of them being frequently seen in the water by early settlers.

From the mouth of the cave several hundred acres of fertile alluvial land can be seen along both banks of the river. In the bottom land lying nearest to the spring branch—which is itself entitled to be called a creek—and extending southward to Miller's residence, partly on an upper terrace, but mostly on the low land, was a village site on which were formerly many small mounds which from the description were undoubtedly house mounds. Mortars occur in numbers, while fragments of pottery and flint, as well as many unbroken implements, were formerly abundant to a depth of several

inches. On the opposite side from the cavern, in the angle formed by the abrupt turn of the river, is another village site. A ditch, with an interior embankment about 6 feet high, formerly extended in a curved line across the point. This fortification was about 600 feet long, coming to the river bank at either end. In the part thus protected were many low, small mounds placed close together but quite irregularly. These were probably house mounds. No trace of any of this artificial work is now apparent except that a difference in color may be seen here and there when the soil is freshly turned, all the earthworks having been plowed and dragged level as interfering with cultivation. A great amount of broken pottery, flint implements, and fragments of animal bones has been uncovered here. In fact, the field is known locally as "the place where the Indians made their pottery." This site seems to have been occupied within historic times; after an unusual freshet some years ago, many "round musket-balls, such as belonged to the old-fashioned muzzle loaders"—"hundreds," or "two gallons," of them is the usual version—were picked up where the loose soil had washed off. There is a local tradition, long antedating the discovery of the bullets, that a "battle" was fought here between the French and the Indians.

On the hill over the cave are three cairns, but they have been so searched through that scarcely a stone remains in its proper place. There is also the site of a flint-working industry, a space 40 or 50 feet across being strewn with spalls, flakes, and chips.

When, in addition to the sustenance provided by deer and other large game, there is taken into consideration the great numbers of wild fowls which frequented the rugged hills and numerous streams; the multitude of small mammals which found security in the myriad cavities and crevices in the cliffs; the abundant food supply in the river; and the further fact that so many mortars and pestles meant the utilization of nuts and the cultivation of corn and no doubt of other foodstuffs as well; it is apparent that the problem of mere subsistence was one with which the natives had but little need to concern themselves. That full recognition was accorded to these advantages is amply attested by the great quantity of flints found everywhere in the vicinity, the numerous workshops on the hills and in the bottoms where the ground is thickly strewn with débris in every stage from the intact nodule or block to the finished implement, and the amount of refuse not only in this cavern, but in the Saltpeter Cave in the same bluff and in the Freeman or Ramsey Cave 3 miles down the river on the opposite side. Miller's Cave, however, possesses an additional advantage, one probably not to be found elsewhere. This is the absolute security of its inmates from the attack of an enemy. The mouth of the cave is in the face of a perpendicular bluff, the

wall on either side so smooth that not even a squirrel can obtain a foothold. The upper stratum of the precipice projects to such an extent that a rope or a ladder let down from above would fall several feet beyond the outer edge of the floor. Below, there is a vertical drop of 30 feet to the top of the rough talus which is as steep as rocks and earth will lie. If an assailant, by approaching from either side, should reach the foot of this bluff he would offer a fair target for stones rolled or hurled down by defenders who are safely out of reach of missiles from any direction.

The only means of entrance is a small opening in the west wall, communicating with another cave. This is so restricted in size as to permit the passage of only one person at a time, and he must assume a crawling or crouching posture. This opening, which for distinction will be called the doorway, has its top, sides, and bottom coated with stalagmite formation; so it may once have been somewhat larger than at present. The limited amount of the deposit over the natural rock at either end of the orifice is evidence, however, that it could never have been high enough for a man to walk through without stooping, or wide enough for two persons to pass each other; consequently one man armed with a club or other weapon could easily guard it against any number who might attempt to enter.

The cavern from which this opening leads, and which will be called the outer cave, is close to and nearly parallel with the face of the bluff, and its course is therefore approximately east and west, forming nearly a right angle with the main cavern. It has a slight curve, so that the doorway is not visible to one who is approaching from the outside until he is within a few yards of it.

The outer cave has its beginning at a point where the bluff bends toward the north; that is, where there is a shallow reentrant curve, formed by the face of the cliff breaking away at this part and rolling down the hill; a considerable portion of this cave itself has been thus destroyed, as shown by another entrance into the bluff beyond. Much talus has accumulated in this cave, over which there is at present a fairly easy though winding and zigzag path to the entrance from the top of the hill, and a rough and difficult way from the bottom. It is a natural presumption that dwellers in the cavern had well-constructed though necessarily devious pathways of easy grade to both the top and the bottom of the hill; but owing to the loose nature of the débris on the outside slopes all trace of these, when abandoned or no longer kept in repair, would soon be obliterated by surface wash, landslides, and the roots of trees.

By the side of the upper trail, at the bottom of the sandstone ledge capping the hill, are many large blocks which have split off from this stratum. On the flat surface of two of these are about 25 figures, pecked into the stone apparently with a pointed flint implement. One

of them measuring 6½ by 30 inches, shown in figure 11, bears some resemblance to a flying bird. All the others are of uniform design, an oval or elliptical figure with a straight line or bar passing through an opening in one end. These vary from 4 to 18 inches in length; two of them are shown in figure 12. Owing to the rough weathering of the stones accurate tracings were not possible, but the illustrations give a fairly correct idea of the inscriptions as they originally appeared.

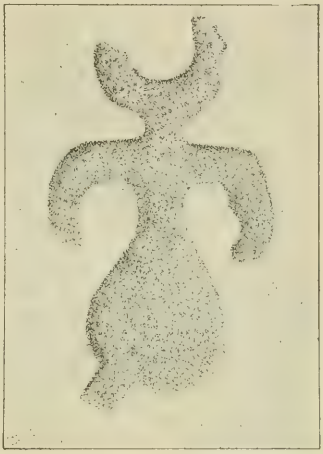


FIG. 11.—Incised figure in sand stone near Miller's Cave.

The front part of the outer cave is partially filled with large rocks, gravel, and clay, which have fallen or been washed in. A window-like opening on the right, or south, side admits additional light. Near the inner end the cave divides, one branch going to the southeast and opening in the face of the bluff, the other turning north and terminating abruptly near the doorway, which is worn through its rear wall. A rough

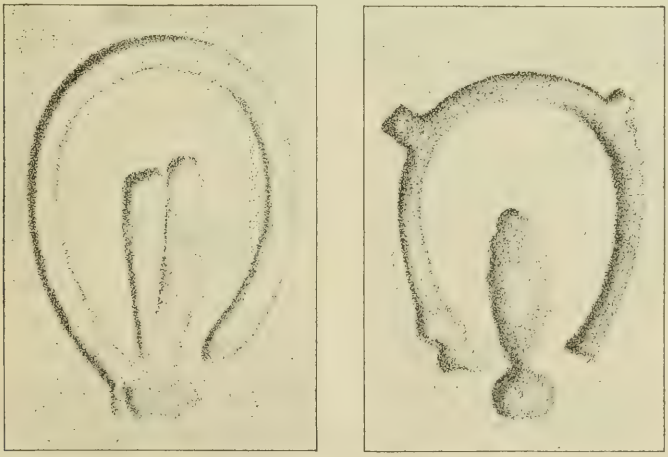


FIG. 12.—Incised figures in sandstone near Miller's Cave.

diagram (fig. 13) with some measurements is appended to show this cavern's peculiar structure.

	Feet.
Width at mouth (A)	17
From mouth to "window" (B)	21
Width of window (B), which has a very irregular outline	3

	Feet.
From window to where cave divides (C)	39
From corner of divide (C) to opposite corner (H)	13
From corner (H) to rear wall	11
Greatest width, from (B) to (F)	22
Width from (C) to (G)	10
From north wall near (G) to face of bluff (D)	28
Height at mouth from talus to roof	8
Height from floor to roof between (C) and (G)	13
Lowest point in the cave (near C), below entrance (A)	7
Mouth, at (D), lower than floor at (C)	4

A small amount of refuse on the floor suggested use of the outer cave for residence or shelter; but excavations at several points uncov-

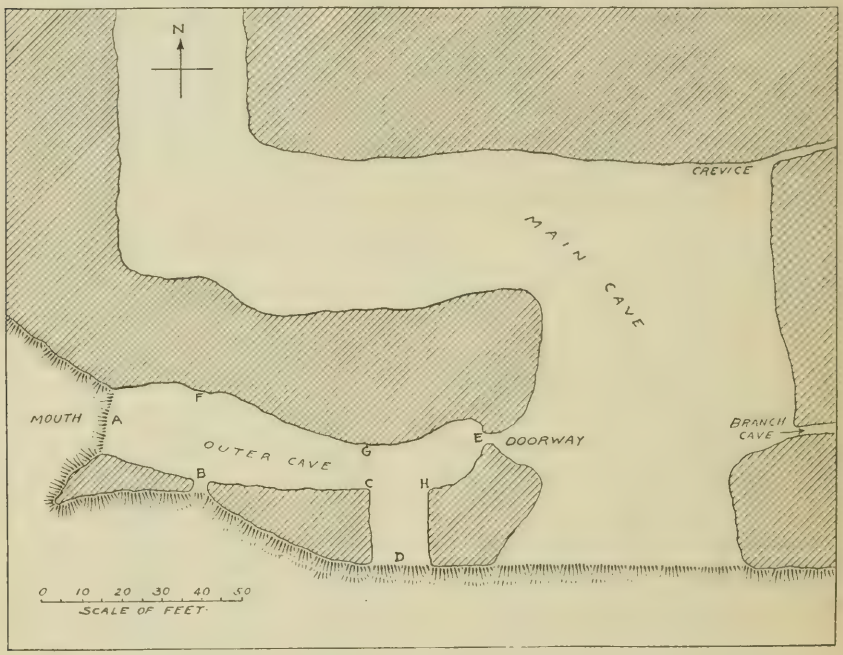


FIG. 13.—Plan of Miller's Cave.

ered bedrock, with very irregular surface, at depths of 6 inches to 2 feet, the earth containing very little refuse and no ashes. On the talus at the entrance, and also at the bottom of the bluff in which the caves open, is much refuse which the inmates threw out as rubbish.

The front chamber of the main cavern is quite regular in form, going straight back like a vault for 80 feet, then turning abruptly westward with a width of 47 feet, the west wall making almost a right angle at the corner. The east wall abuts squarely against the rear; a narrow crevice leads eastward from their junction, but as this was filled with water and mud no exploration in it was attempted.

The floor of the front chamber, from wall to wall, and from near the front to within 27 feet of the rear, was entirely of ashes, no earth being visible until the extremity of these at either end was reached. The floor of the western extension is covered with fine earth, washed in, which gradually increases in volume until it fills the cave to within a foot of the roof. It was not examined beyond this point.

Measurements show these dimensions:

Width of cave at mouth	feet	64
Least width of cave, 24 feet from mouth	do	45
Greatest width of cave, from doorway to branch in cave in eastern wall	feet	74
Shortest distance from line of least width to line of greatest width, as given above	feet	18
From mouth of cave to doorway	do	51
Height of doorway	inches	42
Width of doorway	do	33
Length of floor of doorway	do	[1] 56
From mouth of cave to top of slope of ashes at rear	feet	84
From top to bottom of slope of ashes at rear	do	16
From foot of ash slope to rear wall	do	27
Extent of ashes in turn of cave along foot of wall beyond corner of west wall	feet	22
Width of these ashes, from foot of wall to the pool of water	do	22
Width of cave from corner of west wall to east wall	do	56
From corner of west wall to rear of cave	do	47
Height of extreme front from floor at edge of bluff to most projecting ledge above	feet	35
Height from shelf or ledge near front of east wall to general level of roof	feet	14
Height from ashes to roof at middle of cave	do	10

The walls were, as is usual in caverns, somewhat irregular, there being a narrow bench or shelf along each side near the front, while projections and indentations alternated from front to rear. There were numerous small holes and crevices, enlargements of seams and joints by percolating water at an early stage in the cave's history. These furnish homes for various wild animals, and nearly all of them contain bones, sticks, and trash taken in by ground hogs and wood rats which seem to find much pleasure in carrying such things from place to place.

The work of excavation began at the extreme front of the cave, where the original bottom, a mixture of sand, clay, and chert gravel, had been exposed through removal of the ashes by winds and driving rain. Almost immediately rocks, large and small, fallen from walls and roof, were encountered and interfered greatly with the digging. In the upper foot of the clay were streaks of sand and ashes, among

[1] This measure also represents the thinnest portion of the wall separating the main cave from the outer cave.

which a mussel shell and a flint chip were found; and the top of the clay was quite uneven, appearing as if carried and thrown here, as perhaps some of it was early in the occupancy of the cave, with the object of making a more even or level floor farther back. But this admixture was only superficial; below it, the material had all the appearance of a running water deposit.

A ledge extended along the east wall for 40 feet, with a width of 12 to 14 feet; at the inner end it was about 4 feet below the general level of the floor. At 8 feet below its top a second ledge projected from it, sloping toward the center, slightly for 8 feet then more rapidly for 10 feet farther, where it merged into the bedrock. Then came level, nearly smooth rock for 18 feet, to the foot of the slope of the west wall, 14 feet out from that side of the cave. This was probably the original drainage channel.

By the gradual erosion of new channels through the limestone and the consequent abandonment of old ones, subterranean drainage is continually altering its direction and force. In this way caverns may be left entirely dry, with bare floors; or may, especially if they receive the drainage of sink holes, be partially or even entirely filled with débris thus carried in. Like others, Miller's Cave has undergone such changes. It was begun by clear water; enlarged by erosion and by breaking down of walls and roof; presently clay, sand, and gravel were carried in; finally the water no longer flowed through the front, but found its way out in some other direction. In time the deposits became sufficiently dry to afford a good site for camps and for permanent occupation. There is no way of ascertaining the rate at which these changes took place; it may have required many centuries to make an appreciable difference in appearance; or, on the other hand, the transition from one stage to the next may have been rapid.

Along the foot of the ledge from the east wall the clay was only a few inches deep; farther out on the ledge, and on the projection extending from it, were layers of red sand. Occasionally a small patch of it appeared along the western side. Probably it was washed in among the last of the natural deposits.

There was considerable chert gravel mixed with the clay, making excavation as difficult and laborious as digging up an old, much-traveled macadamized highway.

The surface of the ashes sloped upward rather rapidly for a distance of 29 feet from the front. Kitchen refuse, found in them from the start, contained many mussel shells; bones, including those of bear, deer, panther, turkey, and other large fowls, tortoise, turtle, fish, and various small mammals and birds; potsherds; broken flints, with the débris of chipping work; mortars, pestles, hammers, and mullers. Near the west wall, 14 feet from the mouth, imbedded in

the ashes and a foot below their surface, was a well-preserved cranium, shown in plate 17, *e*, *f*. There were no other bones, not even the lower jaw; it seems to have been thrown here and covered with the dumped ashes.

At 18 feet from the mouth the rocks became larger and so numerous as to be almost in contact, projecting above the ashes and imbedded in the clay down to bedrock; they extended for 22 feet farther in and to within 14 feet of the west wall. The clay attained its highest level at the beginning of this pile of rocks, having an elevation of 9 feet above bedrock; it became lower toward the interior, with its surface everywhere rough and irregular.

The rocks were too large to be either moved or broken up, and owing to the condition of the roof an attempt to reduce them by blasting would have been attended with great danger, so they were perforce left in place and as much as possible of the clay between and under them dug away. Beyond those near the front, others, not reaching the top, were found one after another buried in the clay; owing to their constantly increasing number, and to the inward slope of the east wall, the limits of the excavation gradually narrowed, hampering the movements of the workmen, and it was necessary to handle the earth two or even three times to get it out of the way. There was growing risk, too, of the projecting rocks splitting off or breaking out of the clay matrix. As some of them weighed several tons, the danger became too imminent, and efforts to continue along the bedrock had to cease.

Two other attempts were made to get to the bottom; one at 40 feet from the mouth just beyond the large rocks on the surface, and one at 15 feet farther in. The last one started on an area 8 by 15 feet, which would have been ample if the sides could have been carried down even approximately straight. Neither of these efforts met with success, for the same reason that led to the abandonment of the first one.

From here to the end, examinations were confined to the deposit of ashes. The surface, except as it had been disturbed by relic hunters, was practically level from wall to wall, but the depth varied with the undulating top of the clay beneath. Where it was deepest, in the central portion about 50 to 75 feet from the mouth, the deposit had a thickness of 6 feet. From this it diminished to about 3 feet on the sides, with an occasional thinner patch on a narrow shelf formed by a ledge or a crevice. The average thickness was close to 4½ feet, so the amount was not far from 800 cubic yards. This was composed entirely of ashes from small fires for cooking, heating, and lighting purposes, increased to a very limited extent by kitchen waste, and by discarded or mislaid wrought objects. It represented the combustion of many hundreds, perhaps of thousands,

of cords of wood, all of which had to be carried in from the hilltop or slopes and passed through the constricted doorway. This labor would be a sufficient guarantee of economical use; we may be sure that no fuel was wasted. If proof were needed of such a self-evident proposition, it would be found in the almost complete absence of charcoal; here and there, but seldom, a small mass of it showed that a burning chunk, covered up, had smoldered until the inflammable portion was consumed. Bunches or handfuls of coarse grass or small weeds had undergone the same process. Perhaps these had been used as kindling.

In all the deeper parts the ashes had been dumped promiscuously, from fires made at other points; no camping fires seem to have been made along the middle of the cave until the depressions in the clay had been at least partially filled. The ashes in the upper 4 feet of the ash beds where these were deepest, and in nearly all the shallower portions, were stratified and usually level, though at the front and rear the strata followed the natural incline of the slopes. The first impression was that the ashes had been carefully spread out, or dragged, to make their surface even; but it was discovered, when shoveling some of them for the second time, that ashes may assume this appearance no matter how carelessly thrown. The ashes at the top, to a depth of 3 or 4 inches, were as fine as flour, and when shoveled back hung in clouds for hours at a time, to the great discomfort of the excavators, whose eyes, throats, and nasal passages were in a state of constant irritation. The stratified or laminated, hard-packed condition below the loose surface means, perhaps, that they were occasionally sprinkled and trampled by the occupants to prevent this trouble. Possibly they were covered with mats, skins, weeds, or leaves, in the parts where the inmates congregated. The loose, incoherent condition of the lower portions, which "shoveled like snow," may denote that only a few persons dwelt here at first, who found ample room on the higher ground near the doorway. However, all such attempts at explanations are not much better than mere guesswork, and we must be content with accepting the facts as we find them.

Where the ashes were white and packed hard, whether on the site of a fire or in thin layers where thrown, they contained very little extraneous material; whereas in the darker, more mixed material broken bones, potsherds, shells, and other refuse were abundant, while there was scarcely a cubic foot anywhere in which was not found a piece of flint or bone, sometimes several such objects, which had been intentionally altered from their natural condition.

Near the center of the cave was a curving pile, 6 by 2 feet, and several inches thick, of mussel shells of every size from less than an inch to above 5 inches in length; more than half of them were

over 3 inches. None of them showed any marks of fire; some had both valves in position, as if they had never been opened, and a few of the larger of these had been filled with small shells and closed again. A few were broken, but most of them were entire. About 1,400 valves were in this pile, meaning that at least one-half of that number of mollusks were consumed.

The first interment was found at 46 feet from the front, 14 feet from the east wall. The folded skeleton of a very old person lay on the right side, head east, in loose ashes, on a large flat rock whose top was 30 inches below the surface. This rock had not been placed here, but had fallen from the ceiling; probably its existence was not known until it was uncovered in digging the grave. The skull still retained its shape, in part, being held in place by the ashes, but fell in pieces when this support was removed. A portion of it was gone; two fragments were found, several feet away, not near each other, one of which fits in the skull, and the other probably belongs with it also. The frontal bone is nearly half an inch thick; the sutures partially obliterated; the teeth worn down to the necks, some of them nearly to the bone; the forehead is low and receding. A restoration is seen in plate 20, *a*, *b*. In addition to the missing portions of the skull, most of the ribs, half of the lower jaw, and nearly all the dorsal vertebræ were absent, probably having been dragged away by ground hogs. The bones are all light and fragile. Lying above the skull, in contact with it but supported by the ashes on both sides, was half of a large mortar hollowed on both sides. Above the skeleton, and extending for several feet on every side, was an undisturbed stratum of closely packed ashes, 17 inches thick at the middle, which broke off under the pick in large clods; these, of course, had accumulated after the body was interred.

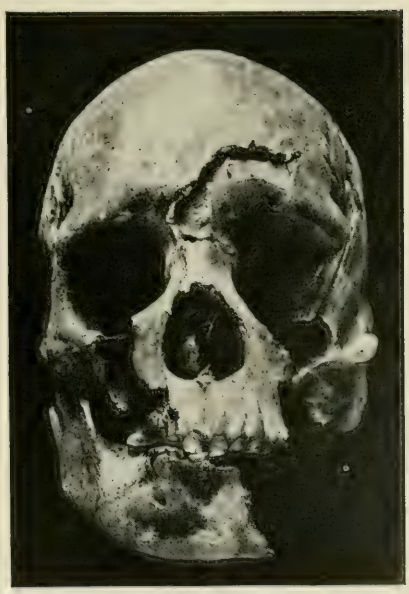
The spongy condition of these bones, in spite of the preservative action of the ashes, is evidence of the fact frequently noted, that with advancing age some change takes place which renders them less resistant to destructive influences. Bones of children only a few weeks old near this skeleton held their structure perfectly and were easily secured.

Ten feet east from the pile of mussel shells, at a slightly lower level, was nearly half a gallon of snail shells which had been boiled, probably in soup. With them were a few pieces of bones.

Scattered irregularly through the ashes were many cavities which somewhat resembled the "postholes" so common beneath the mounds in Ohio. Some were barely an inch in diameter and a foot deep; from this size they varied indefinitely to the largest, which was a little more than 3 feet deep, reaching from about a foot below the undisturbed layers just under the loose surface ashes to within about

a foot of the bottom. "About" is used advisedly, because at this point neither the top nor the bottom of undisturbed material could be determined with certainty. The lower 2 feet of this cavity was uniformly 7 inches across; above this it slightly expanded, funnel-like, to a diameter of 8 inches at the top. The sides of this, as of all of them, large or small, were as smooth and hard as if made with a posthole digger or a boring tool. Strata of ashes, not changing their level or appearance in the least, were continuous around the margin. But the holes were not always straight; some of them changed direction as if due to a crooked post or stick. Nearly all of them were rounded, even hemispherical at top or bottom, or both, like the bottom of a pot. They were not molds, for nothing could have been taken out of them without changing or destroying its form. If they had contained any solid substance like a post it must have stood unchanged until the layers of ashes surrounded and covered it, and then must have so completely disappeared as to leave no trace of its existence. They were not formed by driving any object down, because in that case the bottom would not have been so regularly rounded and the ashes around the sides would have been more or less displaced. They were not due to burrowing animals. In fact, if there be imagined a nearly cylindrical mass of ice, straight or slightly crooked, with rounded ends, placed upright and retaining its position unmelted until completely buried, the appearance of these cavities will best be understood. Some of them were filled to the top with fine loose ashes which occasionally contained fragments of bone, shell, and pottery; sometimes they were nearly empty, with traces of decayed wood at the bottom, mingled with a little ashes and charcoal. In one was found a long, perfect bone perforator, shown at *a* in plate 30; in another near the corner of the west wall was found the pipe shown in figure 14. About 45 feet from the front near the east wall were four of them of different diameters and depths but all in a straight line within a space 2 feet long; these were in front of a crevice under an overhanging ledge where a man could not stand upright. Wigwams may have been erected in the cave, or at least skins stretched to prevent drafts or to confine the heat of fires in winter and perhaps to insure some degree of privacy if this were desired; but there are no present indications of such shelters unless these holes were to secure them; otherwise their purpose or object is still unsolved. They would probably not contain posts for hanging things on when the walls afforded so many small crevices and holes into which poles better adapted for such purposes could be thrust.

Other holes or depressions, shallow, saucer-shaped, or dish-shaped, some dug in the underlying clay, others at any level almost to the top of the ashes, were fire pits or cooking places, containing charcoal



a

b

c

a, *b*, Skull from Miller's Cave, Pulaski County, Mo. (*a*, front; *b*, profile). *c*, Part of skull of child from Miller's cave (front view)

a *b* *c*

SKULL OF YOUNG WOMAN FROM MILLER'S CAVE

a, Front; *b*, profile; *c*, back

and ashes. Two such depressions were lined with a coating of gumbo half an inch thick, which, however, was not mixed with sand or shell. Pots may have been shaped in these. Occasionally a small mass of gumbo, never so much as a peck, sometimes as small as a pint measure, would be found loose in the ashes, seemingly thrown there at random. Two pieces were squeezed into a rough ball; one was patted or rolled into a flattened sphere with a rounded depression on one side. These were no doubt intended as material for making vessels, as was a roughly cylindrical mass of red clay and pounded shell as large as a quart cup—the "biscuit" of modern potters.

About the middle of the cave a saucer-shaped depression, 4 feet across and 10 inches deep at the center, had been dug in the red clay; ashes had been deposited to a depth of 2 feet over this space before the excavation of the hole was begun, and streaks of red clay lay at about this level all around the pit. Many rocks, large and small, apparently thrown in, were in this basin and above it. No fire had been made in it; nothing buried; and the upper layers of ashes extended across it unbroken. It forms another of the unsolved problems.

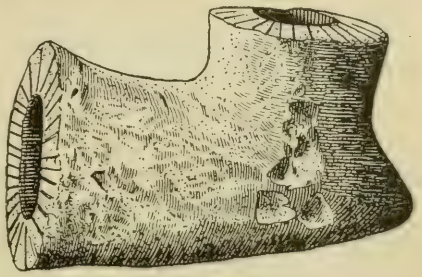


FIG. 14.—Clay pipe from Miller's Cave.

In the den of a burrowing animal smaller than a ground hog was the frontal bone and upper portion of the face of a child of 8 or 10 years; 12 teeth are cut and others can be seen. It is shown in plate 20, *c*. Part of a cervical vertebra lay at the top of the skull, and there were fragments of a few other bones.

The ulna of a child, broken off at the wrist, was near the doorway, in a mass of refuse in a ground-hog burrow. For several feet in every direction around here the ashes were traversed by the tunnels and dens of these animals, some of them extending down into the clay.

Twenty-five feet east of the doorway, a foot below the highest layer of unbroken ashes, was the top and back of a thin skull.

Sixty feet from the front, 15 feet from the east wall, at a depth of 14 inches, was a partial skeleton, lying on the back. The right arm, folded, lay by the side; the left forearm across the pelvis. All bones from the atlas to the sacrum, except some bones of the hands and wrists and the left ulna, lay in such position as to show they had been interred with the flesh on, or at least while the cartilages

held them together; but no trace of the skull—which had lain toward the west—or of any part of the legs or feet was present. Fragments of coarse cloth were adhering to the pelvis. The bones, which were almost like punk, were those of a young person, the caps of the long bones being separate from the shafts; but they were of good size, the humerus being 13 inches long. The left ulna (at least *a* left ulna) lay above where the face should have been, but some inches away, with one end near the surface. It is quite probable that ground hogs are responsible for the condition of this skeleton, and that some of the bones found scattered in the ashes belonged to it. About a foot under the bones, but not connected with the burial in any way, were three large pieces of a large pot.

Four feet east of this, a foot lower, was the skeleton of a baby, the humerus only 3½ inches long. The bones rolled out with some loose ashes, and not all of them could be recovered.

Thirteen feet from the east wall, 16 feet from top of rear slope of the ashes, 4 feet below the surface was part of a skeleton. The bones lay on a damp, close-packed bed of ashes 6 inches thick. They were closely folded, the femurs and lower leg bones being in contact; the skull, scapulæ, right humerus, sacrum, and some of the vertebræ were missing. Such bones as remained were in their proper positions, except that the sternum lay in the pelvis and the elbows at the knees. All of them were in a space only 18 by 22 inches, measuring to the outermost points. The situation of such bones as remained indicated that part of a skeleton had been buried after the flesh had decayed, or had been removed, but while the joints were still united, and covered with loose ashes, whose settling had caused some sagging of the stratified ashes, a foot in thickness, which lay above them, there being no evidence that they had been disturbed since they were placed here. All were as light as cork and, except the left tibia, which was 15½ inches long, fell to pieces when taken up.

Eight feet east from the last skeleton was one of a very young infant, on left side, head toward the front of the cave. It was 2½ feet below the surface, partly under a jutting portion of a large rock whose top was above the ashes. It lay on small angular rocks, with similar rocks over it.

Two feet west of this was the ulna of a child 10 years old.

Sixteen feet from the east wall, 10 feet from top of rear slope, 2 feet under surface was another infant's skeleton, lying on the back, head toward the mouth of the cave. The femur was only 4½ inches long.

Fifteen feet from east wall, 8 feet from top of rear slope of ashes, a little more than a foot below the surface, was the closely folded skeleton of a woman between 20 and 25 years of age. It lay on the right side, with the head east. The bones were in perfect condition,

even the coccyx being intact. All the teeth were present, solid, and symmetrically set. Unbroken strata of ashes a foot thick above this skeleton sagged somewhat owing to settling of loose ashes thrown around and over the body at time of burial. The skull is shown, front, profile, and back, in plate 21.

A few inches below these bones, with ashes intervening, were piled some bones of a child of about 8 years. The caps of the joints were not adherent, and some of the teeth had not come through the bone. The skull, which was intact, lay on left side, vertex north, ribs, arm bones, and feet bones lay on the top, at the back, and at the vertex, in contact with the skull and with one another. As there was no evidence that they had ever been disturbed by animals, it would appear that only the bones mentioned had been deposited; even the lower jaw was absent. They lay in a mass of kitchen refuse, shells, burned bones, charcoal, and ashes, the upper layers of which were curved as if the bones had been laid on a level area of this mixed material and the rest of it piled over them. Their position, and the small number of them, indicates that the flesh had been used as food. The skull is shown in plate 22.

Between this partial skeleton and the complete one above it, apparently thrown in with the refuse which covered and surrounded both, were fragments of two large pelvic bones which did not belong to either of them.

Directly below these burials, 3 feet under the surface, was part of an infant's skeleton, with five shell disk beads among the bones; the only instance in which ornaments were found with human bones. The skull and some other bones were present, but most of the remains had disappeared into the runway of a burrower.

At several places in the central parts of the cavern, at almost any level between the top and the bottom of the ashes, were human bones, singly or a few together, some of them apparently remains of interments, others carried to the points where found. Most of these scattered bones were of children or infants; but now and then larger ones were found, notably two large adult tibiæ which were a foot apart. While a few of them may have been thrown in with the ashes, most of this confusion resulted from the activity of rodents, though some of it was due to desultory former investigations.

At one point was the perfect lower jaw of a child 8 or 10 years old; with it were a scapula and some vertebræ which may have belonged to it, also some ribs, vertebræ, and arm bones of an infant. Two or three of them bore marks of fire, especially an ulna of a child which was completely charred.

Four feet from east wall, 4 feet below surface, at the beginning of the slope to the rear, was the skeleton of a child less than 2 years

old. It lay on left side, head east, legs bent, one arm folded with hand by head, the other along the body; just such a position as would be assumed by a sleeping infant. Some of the teeth were cut. All the bones were in place, though soft and brittle; above them was an unbroken stratum of ashes.

Four feet west of this, 2 feet higher, was the skeleton of a still younger child.

Sixteen feet from east wall, at the beginning of slope to rear, near the bottom of the ashes, was an adult's skeleton, extended on back, head west. Three rocks, weighing from 75 to 300 pounds, were placed over the body. Most of the bones had disappeared from decay; the middle third of one tibia was much enlarged by disease, as shown in plate 23.

Eleven feet east of this, 4 feet below surface, was an adult skeleton, folded, on right side, head toward rear of the cave. The bones were spongy and soft. Portions of the feet and legs, most of the pelvis, the left arm, and some of the vertebræ were present, but there was no trace of right arm, skull, or shoulders. A slab weighing 100 pounds or more was set on edge just where the head should have been. One tibia, the only bone with both ends remaining, measured 14½ inches.

Near the wall, just beyond the break of the slope, was the entire skeleton of a dog so old that its teeth were rounded and smooth. It had been killed by a spear thrust entirely through its body, from the right side, both scapulæ being penetrated; the holes are three-fourths of an inch in diameter. The skull of a fox was found near this, higher in the ashes.

Fifteen feet from east wall, halfway down the slope, 18 inches under surface, was the skeleton of an infant only a few days old. No trace of pelvis or right leg remained, though all the other bones were well preserved.

Twenty-four feet from east wall, at beginning of rear slope, was the complete skeleton of a young child, extended, on back, head toward rear of cave. The bones showed evidence of disease, as may be seen in plate 23. The skull is shown in plate 24.

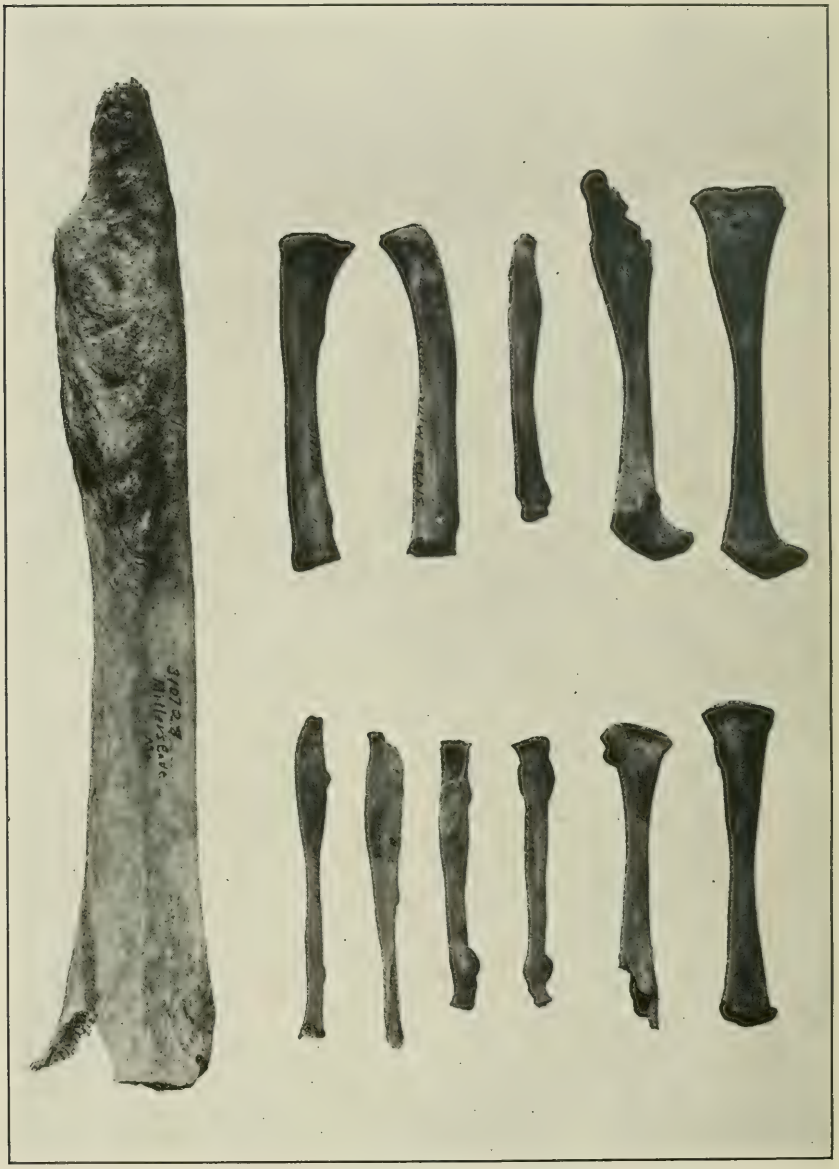
Nineteen feet from east wall, 13 feet from foot of slope, was a hole 4½ inches to 5 inches in diameter, 21 inches deep, extending into the loose dark earth underlying the ashes. The bottom of the hole was muddy, being at about the level of the standing water, and contained charred and decayed remains of oak wood. Ashes, in layers having the same slope as the surface, extended over it, proving the post (?) to have been burned some time before the cave was abandoned.

West of the doorway a ledge, projecting from 4 to 6 feet, extended to the west corner. It was covered 2 feet deep, or less, with ashes containing the usual refuse. Large rocks lay on this, or had fallen

a *b*

SKULL OF CHILD FROM MILLER'S CAVE

a, Front; *b*, profile

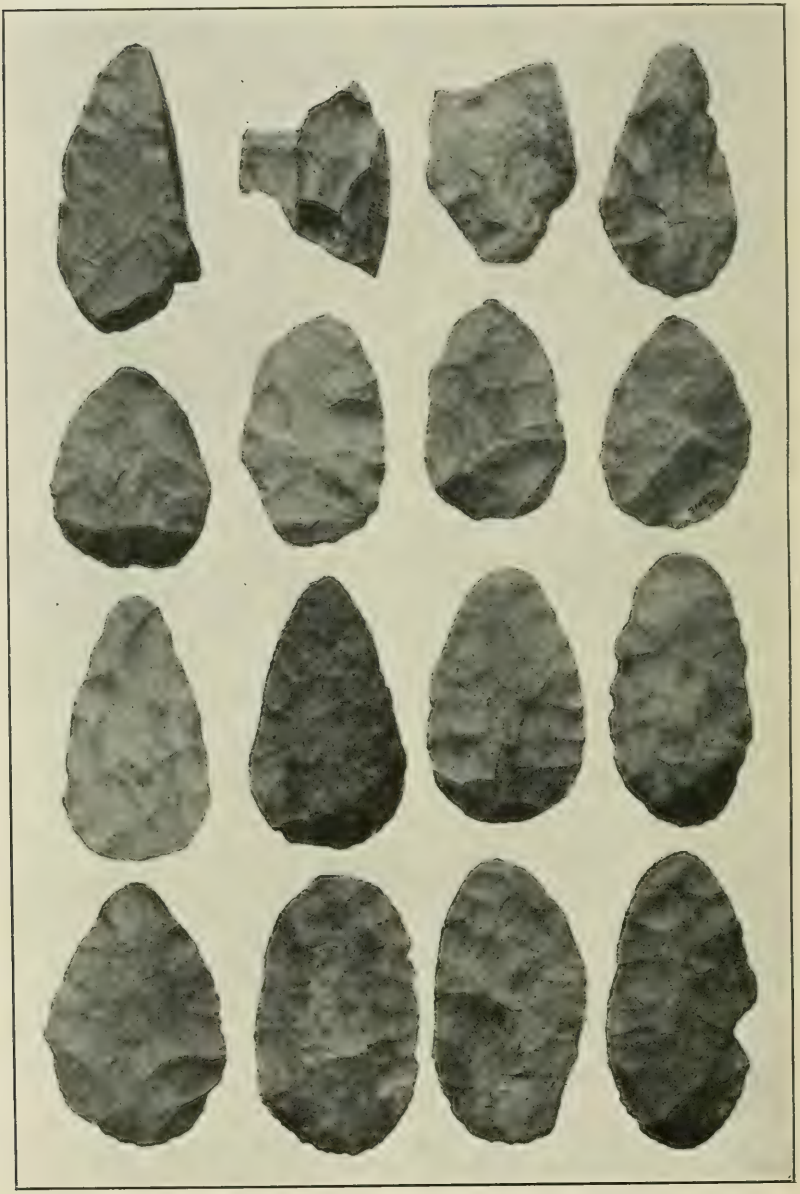


DISEASED TIBIA OF ADULT AND DISEASED BONES OF CHILD FROM MILLER'S CAVE

a *b*

SKULL OF CHILD FROM MILLER'S CAVE

a, Front; *b*, profile



CACHE OF FLINTS FROM ASH BED IN MILLER'S CAVE

over it to the clay lying against its lower part, or into the ashes on the clay.

Near the west wall were four holes in an almost straight north-and-south line. The first (1), was 29 feet north of the doorway, 18 inches deep and 7 inches in diameter. In it was the clay pipe shown in figure 14. Number (2), 5 feet from (1), was 24 by 9 inches; No. (3) 2 feet from (2), was 26 by 7 inches; No. (4), 4½ feet from (3), was 30 by 5 inches. Fourteen inches northwest of No. (1) was another hole, 15 by 3 inches. The description on a previous page as to character, appearance, and contents applies to all these holes; the ashes extended above all of them in continuous layers.

A little to the west of No. (1) was a small pile of crumbling fragments of sandstone and limestone used in boiling food.

Near No. (4), a foot under the surface, on the slope, 15 feet from the water, was a small pile of charcoal on which lay a human scapula, some vertebræ, fragments of ribs, most of a humerus, and most of a femur of a person not fully matured; they were of good size but the cap fell away from the humerus when it was moved. Some of them were without marks of fire, others were charred, while a few pieces were burned to cinder. As the mass was surrounded by clean ashes, it could not be determined whether the charcoal had been burned where found, or had been carried here. Whichever it was, the bones had been thrown on the pile.

Thirteen feet just north from the corner of the west wall was a hole 19 by 7 inches which differed from the others in that the bottom instead of being rounded was irregular, and deeper at one side; the top, however, showed the usual hemispherical contour.

Two feet from corner of west wall, almost under a point projecting from it, 4 feet below surface, was a cranium from which the upper jaw, one orbit, and part of the right parietal were missing; with it were a lower jaw, a clavicle, a sternum, the bones of the left arm, and some phalanges, all in good condition, except the ulna, which was broken. No other bones were present. The skull lay on right side, face toward the wall; the arm bones were on it, and the other bones by it. With and around them were some deer bones. The entire lot had the appearance of being thrown together here at one time, and it would seem that the flesh of all of them had been eaten.

Fourteen feet north from the corner, halfway down to the water, in the wet earth at the bottom, were human bones evidently placed here entire, but so decayed and broken that nothing could be ascertained except that it seemed a closely folded body or skeleton had been deposited. The teeth were worn down to the gums.

The refuse behind the corner of the west wall was cleared away as far as the conditions would permit. The amount of water at the

rear of the cave varies with the rainfall; sometimes it almost disappears, again it may be fully 2 feet deep; but at all times the earth and ashes near it are saturated above its lowest level. Consequently, on account of the mud, excavations could not be carried fully to the end in either direction. As scarcely anything was found in the last few feet, this omission was not important.

The entire distance worked over, from the front margin to the line where no further advance could be made, at 14 feet from the water, was 91 feet. No spot that could be reached throughout this length was left undug.

The small openings in the west wall presented no features worthy of special mention; but those in the east wall yielded interesting results.

First of these was a small cave 39 feet from the main entrance. At the front its width was 11 feet; 6 feet within it narrowed to 4 feet. A hole on the north side ended at a crevice that led to a chamber higher up, from which, in turn, another crevice extended. All this space, even beyond the point to which a man could worm his way, was filled with fine earth and ashes containing much refuse. Worked objects were found at the greatest distance which could be reached.

A few feet within the entrance this minor cave divided into three parts. A crevice trending northward is too small to follow. The two others extend in a general easterly direction. The central branch, the left of the two, also closes within a few feet. Neither of these contained anything but natural earth. In the one to the right, 7 feet from the entrance, was a pocket on the south side, 18 inches wide, 30 inches high, and 4 feet deep; it was filled with ashes containing bone and shell, but no worked object except a flake scraper. At intervals, within the next few feet, were two mortars, a much used pestle, some bone awls, and flints, all of them in places where it was scarcely possible for a man to sit erect, as the tunnel-like cavity, circumscribed by solid rock, was nowhere as much as 4 feet in diameter. At its narrowest part it measured only 3 feet high and 18 inches wide.

At 20 feet the cave opens into a well-like enlargement, 5 by 6 feet, and 5 feet high. Bone and shell in small amounts were found here, and among them the skiver shown at *d* in plate 36.

From this well-like cavity three branches start; one continuing in a direct line east, one to the north, and one to the south. The east (middle) branch is only 24 inches high and 17 inches wide, with solid rock all around. It contained ashes, with a little refuse, as far as a man could reach.

The branch to the north is entered through an opening 3 feet high and 31 inches wide in a thin wall of the original rock, just within

which it widens to nearly 7 feet, holding the same height of 3 feet. Within this doorway, on the red earth bottom, were a small mortar and a grinding stone worn by much use; both were stained with red paint. A foot farther in was part of a skiver; and 2 feet beyond this was a large knife of white chert almost as clear and compact as chalcedony, shown at *a* in plate 27. Ashes continued in the north tunnel for 26 feet from the entrance, beyond which no further progress was possible. Before this point was reached, the refuse which had been continually decreasing in amount no longer appeared.

The tunnel leading from the well toward the south is 19 inches high, 3 feet 9 inches wide. At 3 feet it branches; one fork, 2 feet high and 17 inches wide, turns eastward and curves to join the east branch from the well. The other branch continues south, but soon closes; in it were found a small piece of an adult's skull and the hip bone of a young child.

The floors in all the branches of the small cave were covered from 3 to 12 inches deep with a reddish mixture of sand and clay, on which were ashes filling the space above almost to the roof. In a few places refuse was found in this silt, of the same general character as that in the ashes, but in very small amount. This is not significant; such remains were dragged down by animals, which range everywhere. The two deposits are quite separated and distinct.

The clay and sand on the rock bottom came from disintegrated rock on top of the ground outside, or at any rate from some level higher than that where they are found now; but how ashes, shells, broken bone, and especially how worked objects came to be in places too contracted for a man to creep, and where they could be neither carried nor pushed, is not to be explained except on the hypothesis of a chamber above, whence they may have worked or may have been thrown down; but at no place, either in the cave or in the outside surface, could there be found any evidence of such communication.

Fifty-five feet from the mouth of the cave, in the east wall, is a crevice into whose lower portion extended the red clay of the cavern floor. It branched into various tortuous divisions, all of which were filled with ashes containing a large proportion of refuse. It appeared at first that all this had settled in, or been thrown in, from the main cavern; but one branch, having a very irregular outline, was in such situation and trended upward at such an angle that it could not have been filled from below. As in similar cases previously noted, however, no other opening to it was to be found. The smallest workman cleared it out to as great a distance as he could crawl and use a trowel, but did not succeed in reaching the end of the deposits.

At the bottom of the crevice were ground-hog burrows extending between loose rocks, under ledges, and into the red clay. All these

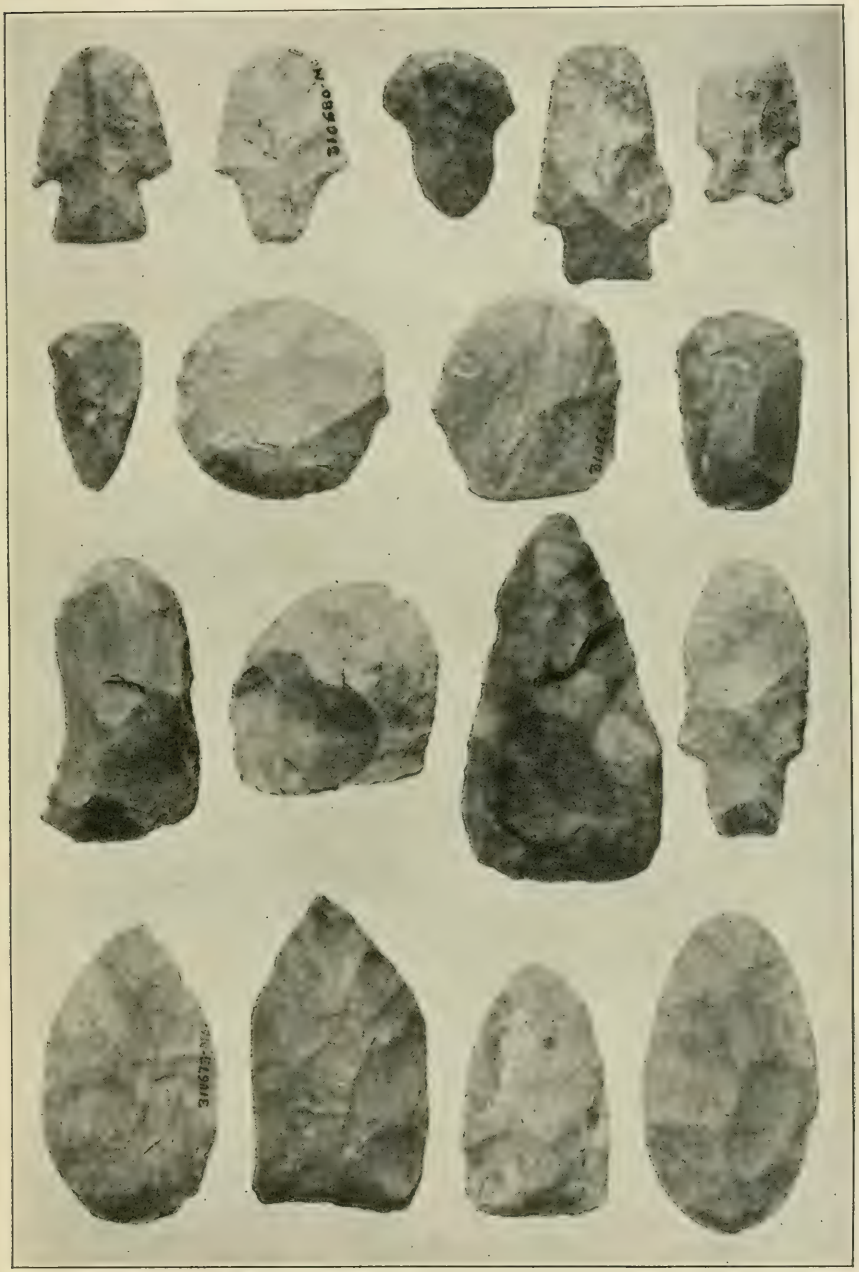
were followed as far as they could be, and found to contain quantities of refuse. There was also a considerable amount of fine dark earth in the burrows, showing they have another outlet somewhere. Occasionally a mass thrown out by a shovel or a trowel contained more refuse than ashes. There was nearly everything which was found elsewhere in the cave, and almost every shovelful contained something worth preserving.

Near the rear of the cave erosion of the lower part of the eastern wall formed a rudely triangular recess or cavity 30 feet long by 7 feet deep at the widest part. The upper margin of this was below the surface of the ashes, so that its existence was not suspected until these had been removed from in front of it. The roof was 5 feet above the rock bottom, the entire space being filled with loose material. The upper 2 feet of this was clean ashes in which were great quantities of refuse, so much that it had all the appearance of a general dumping ground. Below this depth, patches of fine dark earth were mingled with the ashes and refuse. The latter continually decreased in quantity, until at a foot above the bottom they ceased altogether, the lower portion of the deposit consisting of nothing but earth. The pure ashes were slightly damp; and the moisture increased with the depth until at a foot above the bottom the earth was saturated and could no longer be removed with tools.

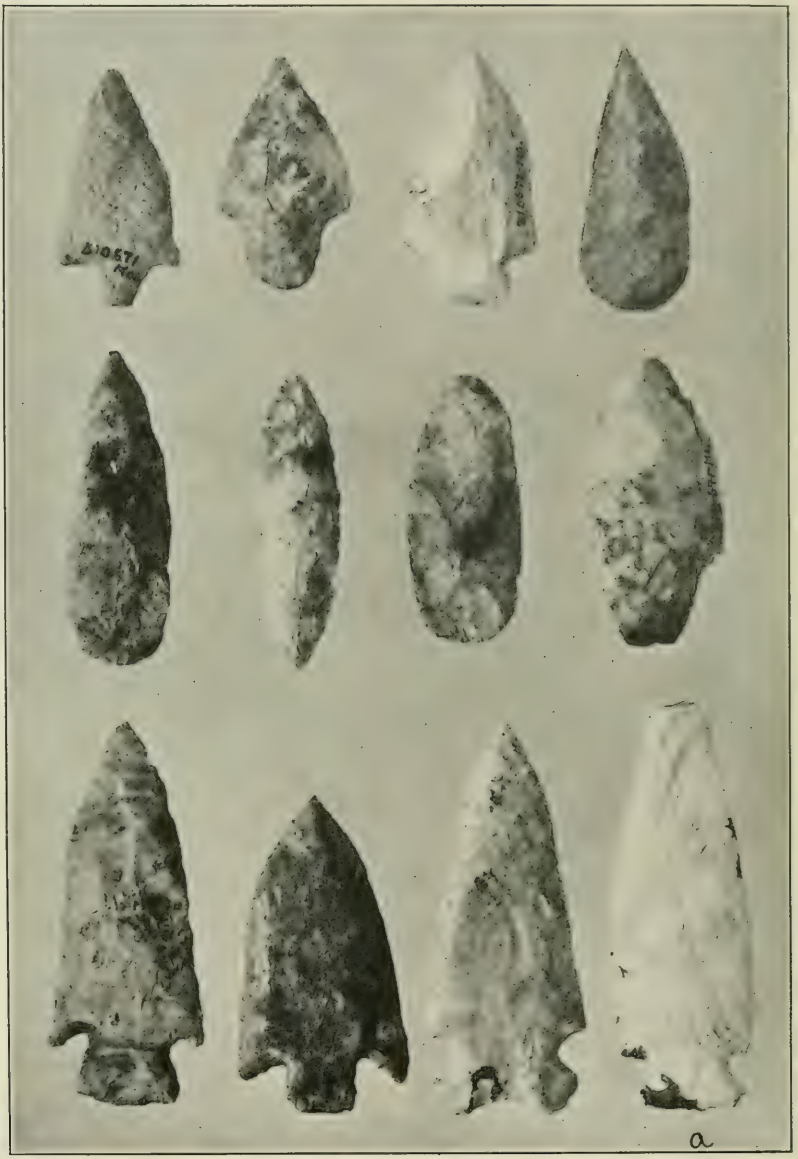
The refuse in the ashes consisted of animal bones, entire or in fragments; broken flints and pottery; mussel and snail shells; and numerous wrought objects. These continued, though in smaller amount, where the ashes were mingled with earth, though bones and shells were soft owing to the moisture, and could be removed only in fragments. Among them were the flint shown at *a* in plate 28, and the hematite ax, at *a*, plate 29. The latter was at the lowest level to which the ashes extended; perhaps its weight caused it to settle below the place at which it originally lay.

Near the middle of this chamber, 2 feet from the rear wall, lying at the bottom of the mixed ashes and earth, were 12 entire and 3 broken leaf-shaped blades; they were not closely piled, or arranged in any order, but seem to have been hastily or carelessly laid or thrown on a small space. Another was found a foot away. They are shown in plate 25.

Here and there among the refuse were found the upper jaw, with left orbit, of a young person; a fragment of an occiput, perhaps belonging with the above though not lying near it; fragments of the skull of a young child; half of an ulna of a child probably 12 years old; a small fragment of the lower jaw of an adult with one molar remaining in it, which has been burned until black. These fragments were all in such position and condition as to show they were not carried in by animals; were not disinterred from graves and placed



FLINTS FROM MILLER'S CAVE



FLINTS FROM MILLER'S CAVE

FLINTS FROM MILLER'S CAVE

AXES AND PESTLES FROM MILLER'S CAVE

here; were not in any way accidentally present; but had been gathered up with the refuse and thrown in as a part of it. The broken or burned condition of these, as well as of other human bones found at random among the ashes of the main cave, are presumptive evidence that dwellers here sometimes devoured the flesh of human beings; and the fact that a majority of such bones are those of children indicates that it was not eaten through a belief that the valor and skill of an enemy could be thus absorbed by the victor, but that it was used as food, like the flesh of any other animal. Such conclusion may not be justified; but the facts are not readily accounted for otherwise, except on the equally repulsive hypothesis that the inmates of the cave were brutally indifferent to the bodies or skeletal remains of their fellows.

Omitting this question from consideration, however, there is still ample evidence that the inhabitants of Miller's Cave were in a low state of savagery, or, if the phrase be preferred, in a very primitive stage of culture. There was a remarkable paucity of articles used as ornaments or for personal decoration, and the few that were found were simple and crude, being only rubbed stones or rough pieces of bones which were possibly intended for beads or pendants. The pottery, while strong and serviceable, was plain in form and devoid of any ornamentation or design except that a few pieces showed impressions such as would be made by scratching or pressing with the end of a small stick or bone. Nearly all of it was cord-marked, though some was smooth, one red piece appearing almost glazed. It varied much in thickness, hardness, and color. Most of it was dark gray, some red, occasionally a piece yellowish or nearly white; due to the different clays of which it was made. So far as observed it was tempered with shell. The shards were small, as if when a pot was broken the fragments were still further demolished. The curvature showed there was a wide range in size, from about a pint to 2 gallons or more.

Their mortars were natural blocks or slabs of sandstone, such as may be picked up by thousands in the immediate neighborhood, and showed no alteration of form beyond ordinary wear except that the rough faces of a few were pecked, apparently with a pointed flint tool, to make them less irregular. Some were flat and smooth from use with a muller or grinding stone; most of them were worked or hollowed on only one face; a few showed depressions on both sides; one had a few hemispherical indentations near the margin, like those observed in cup-stones.

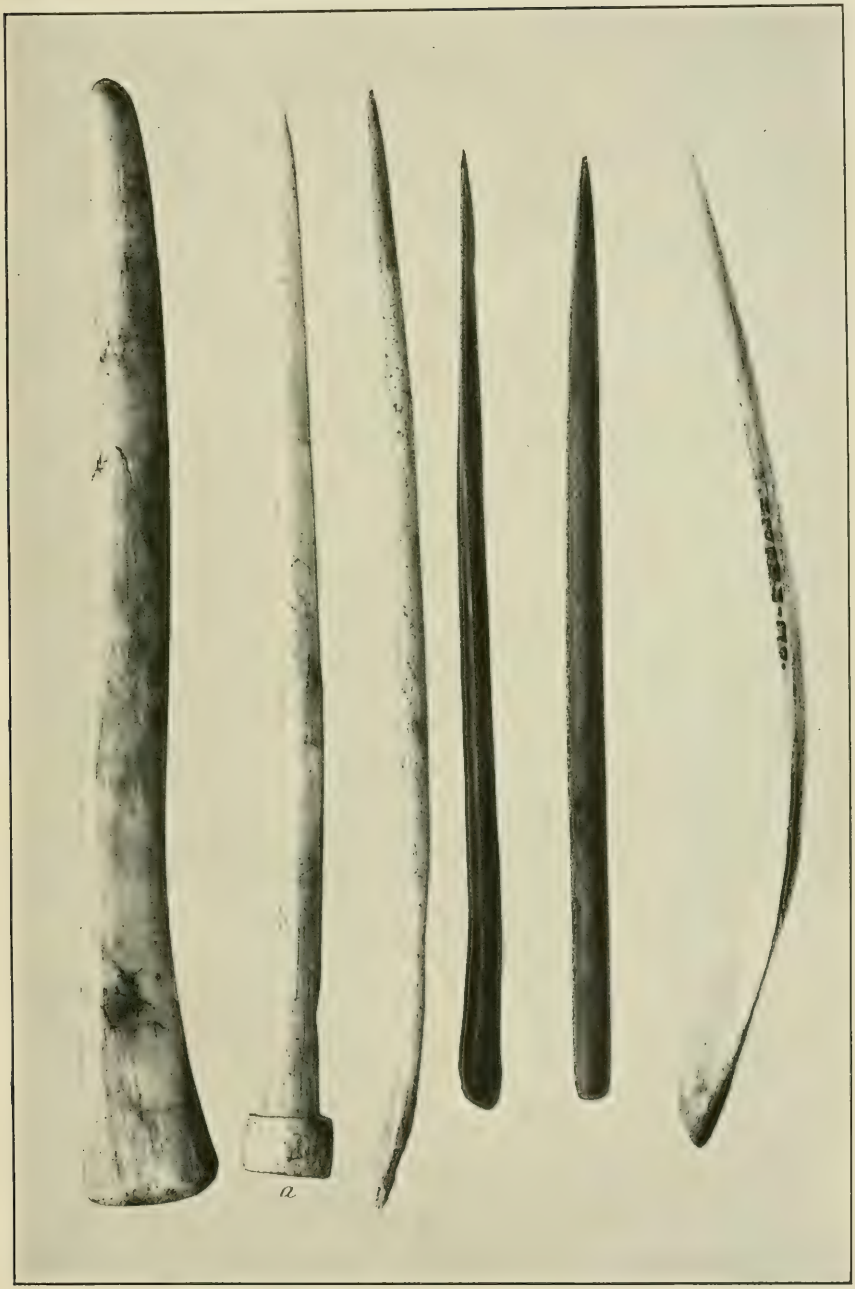
Only one pestle was dressed into any of the forms which we are accustomed to associate with the name, and this was a truncated cone with rounded top, shown at *b* in plate 29. All the others were cobblestones from ravines or the river shore. A few had undergone

no change in form; most of them were battered on the perimeter; a few had pitted sides; some had been used as pestles, mullers, or grinding stones until the surface was more or less smooth. All such stones are classed as "pestles," for convenience; they could have also been used as hammers, bone crushers, and in various other ways.

In all, 73 mortars were found; counting only those stones which bore marks of use as such. The largest one was at the bottom of the ashes, near the doorway. There were more than 100 pestles which bore evidence of much use; and probably as many more on which there was little or no sign of wear. As the cavern was not of sufficient size to provide living quarters for many families at any one time—10 or 12 at the most—the large number of these utensils may imply that the inmates would not use an object which had previously belonged to some one else.

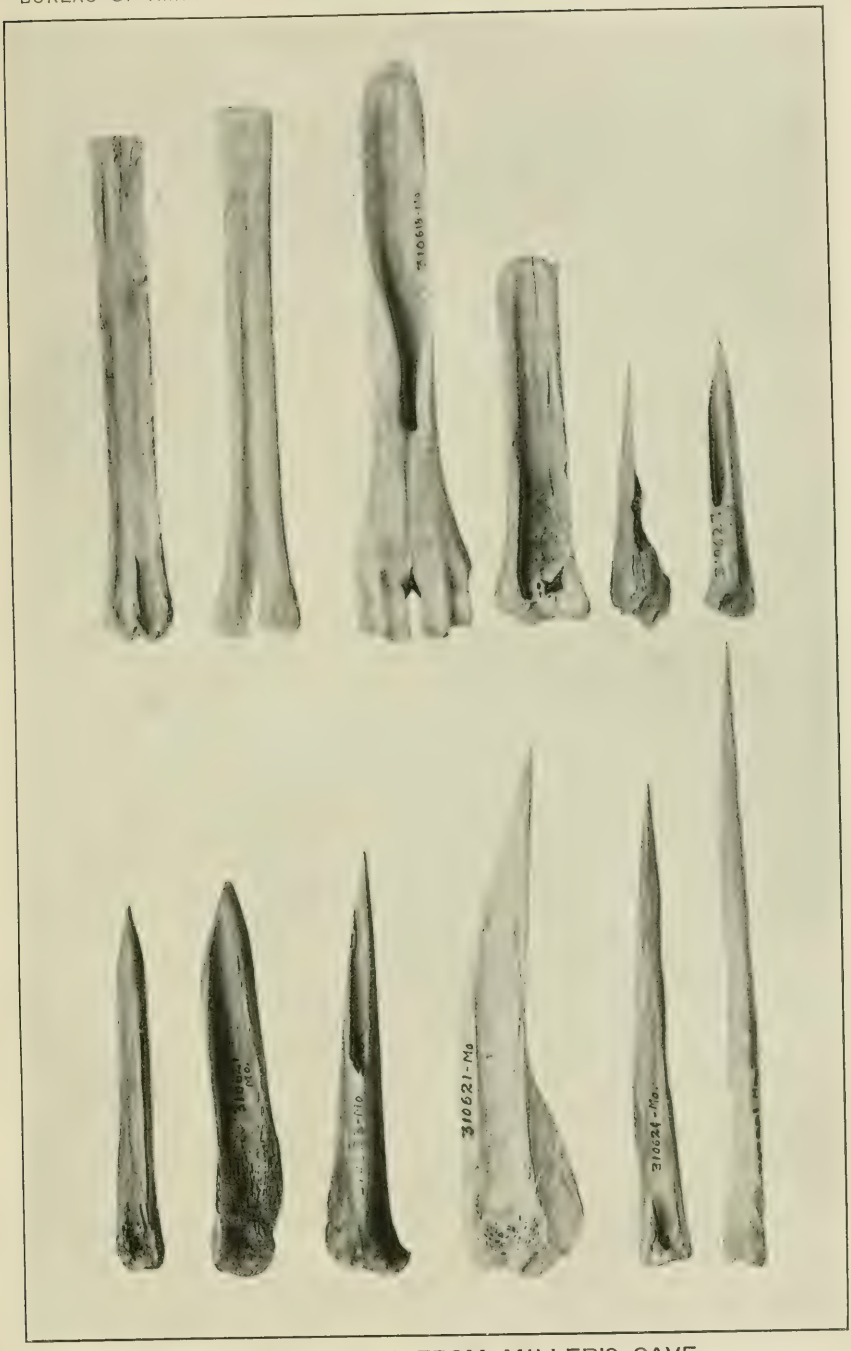
Among the flint implements there was a wide range in the character of stone, the shape, and the degree of finish, although the variation in size was quite limited. Very few of them may be classed as either large or small. The longest, shown at *a* in plate 28, measured 5½ inches; few were more than 4 or less than 2 inches. Tapering stems predominated. The principal forms are shown in plates 26–28. Only three arrowheads were found; but this was to be expected, as arrows would be used only out of doors. One of these of clear, fine-grained pink and white chert, shown at *b* in plate 28, so far surpasses in delicate finish any other specimen secured that it is probably exotic. The large number of cores, blocks, spalls, and flakes shows that many implements were made and repaired here. But, while a few specimens showed that their fabricators were masters of the chipping art, most of them were roughly finished. Some which are so little altered from the original form of the rough flake or spall that they would be classed as "rejects" if found about a flint workshop have a smoothness or "hand polish" which denotes much service. There is the possibility, of course, that hunting or traveling parties from some other part of the country may have availed themselves of the shelter, either when it was temporarily unoccupied, or as guests of those living in it; and that these, also, may have left some small articles when they departed. However this may have been, all the objects from the top to the bottom of the deposits, in dry ashes or in sticky mud, in crevices or branch caverns, on the red clay, the barren muck, or the bedrock—all, if we may except the few flints of superior workmanship—are identical in general character: That is to say, any object from any part of the deposited material had its practical duplicate at various other points on different levels.

Only three grooved axes and three pestles were found. They are shown in plate 29, along with a cobblestone used as a pestle.

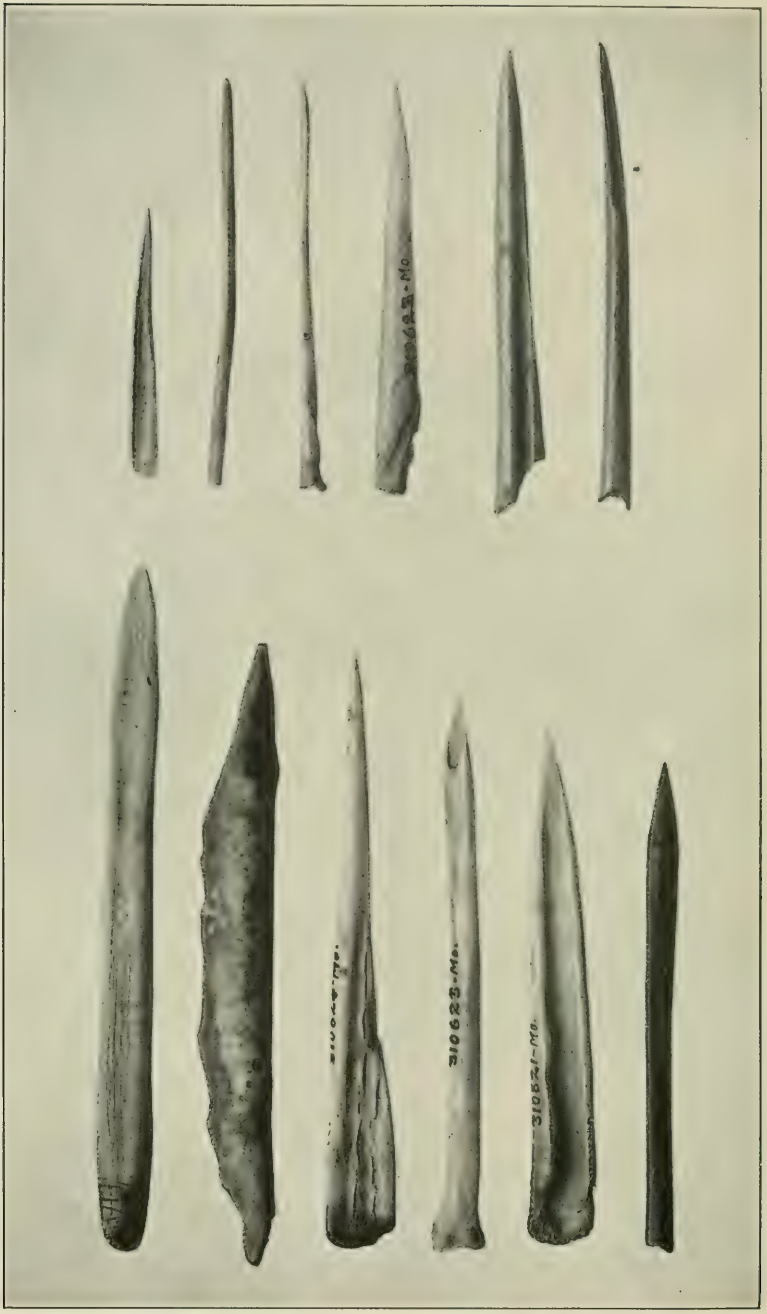


BONE IMPLEMENTS FROM MILLER'S CAVE

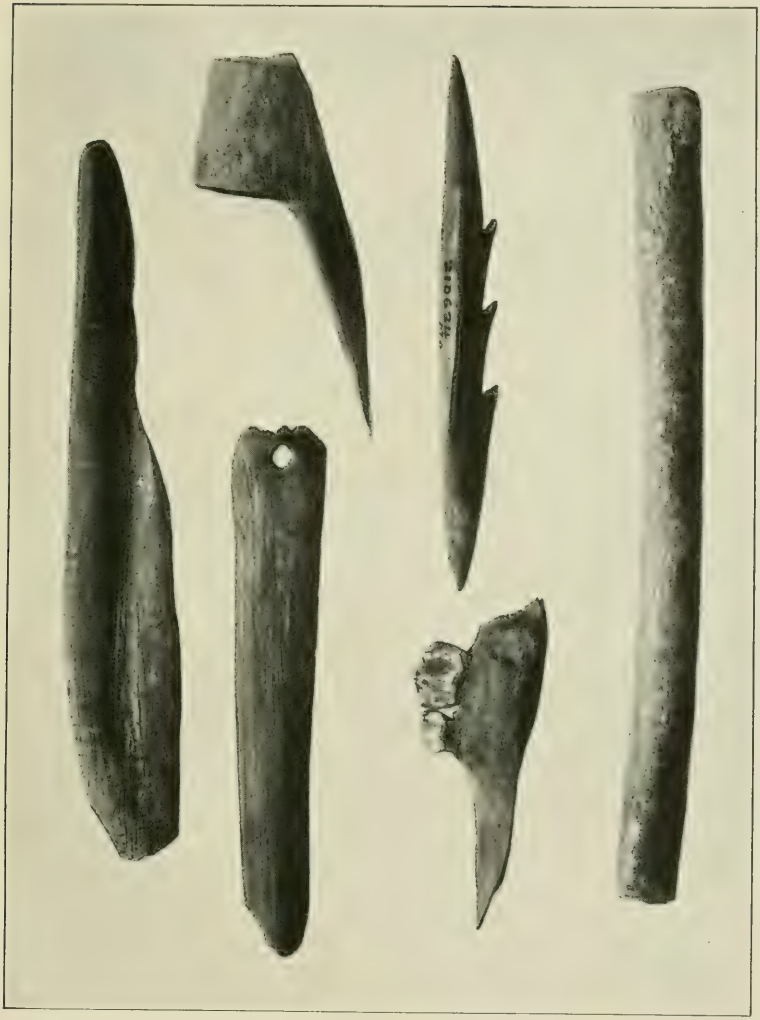
BONE IMPLEMENTS FROM MILLER'S CAVE



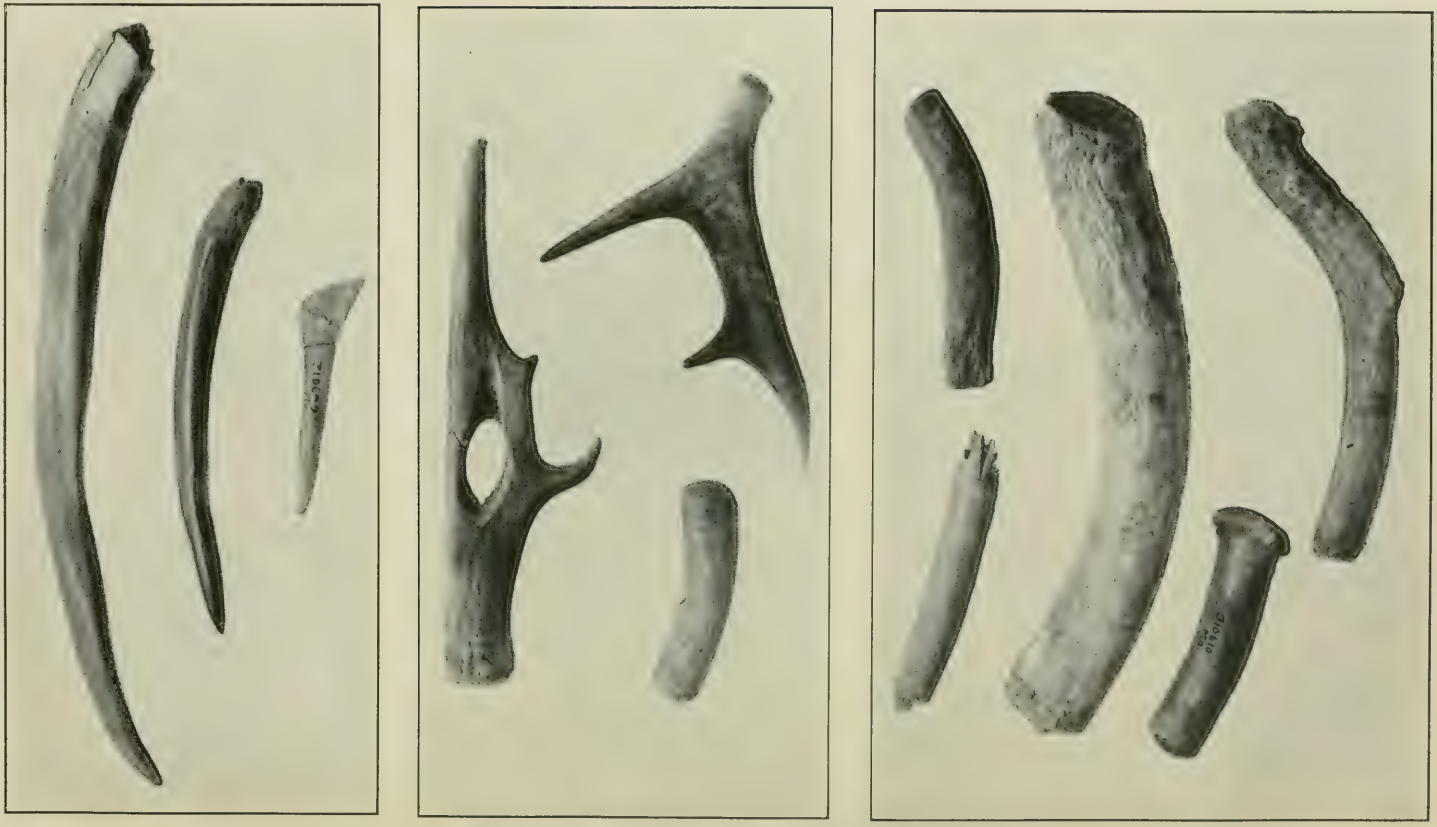
BONE IMPLEMENTS FROM MILLER'S CAVE



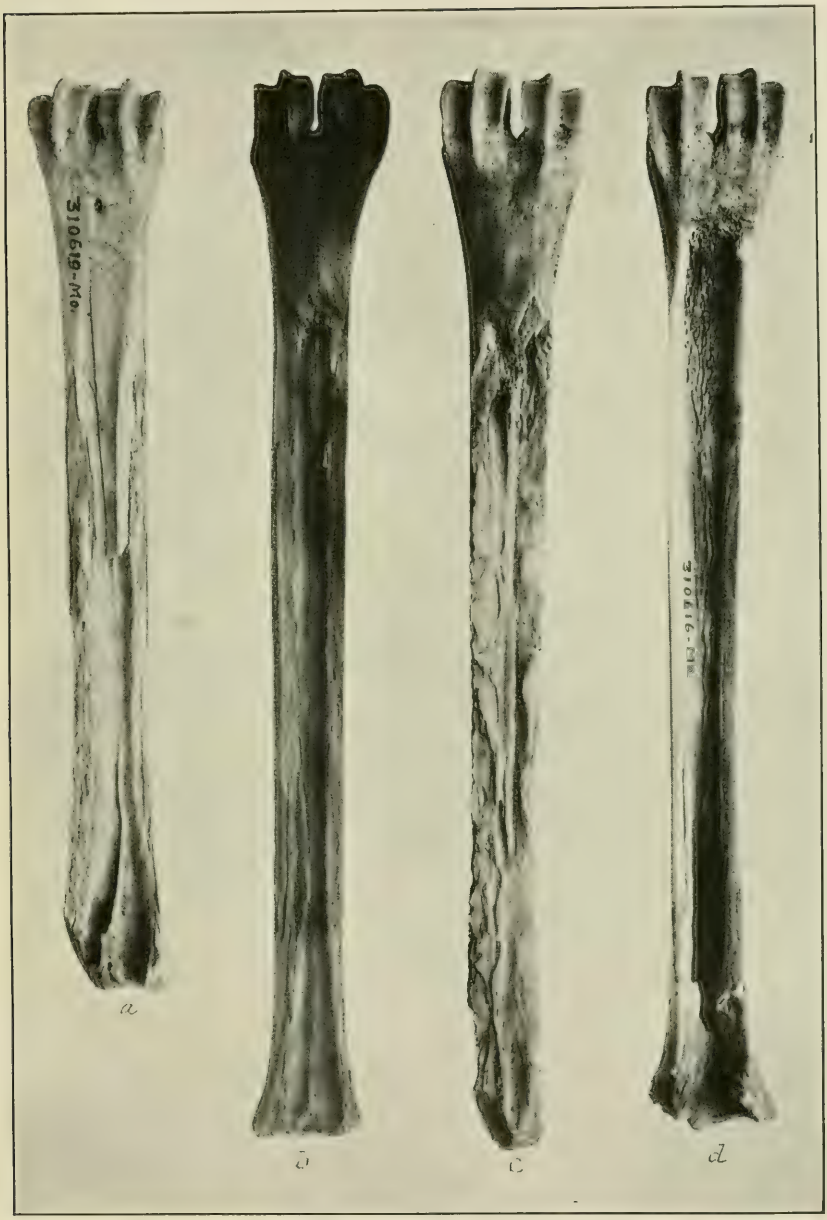
BONE IMPLEMENTS FROM MILLER'S CAVE



BONE AND ANTLER IMPLEMENTS FROM MILLER'S CAVE



ANTLER IMPLEMENTS FROM MILLER'S CAVE



SKIVERS, SHOWING STAGES OF MANUFACTURE, FROM MILLER'S CAVE

SHELL SPOONS, POTTERY DISKS, AND BROKEN SPOON MADE OF A DEER'S SKULL, FROM MILLER'S CAVE

The cave was especially rich in objects wrought from bone and antler. A few of these are shown in plates 30–36 and figure 15.

Plate 36 illustrates four stages in the manufacture of skivers. It shows that instead of being always rubbed down from its natural form the bone was sometimes split by blows of a stone hammer until complete, subsequent smoothing probably resulting from use, as shown by the implement at *c*. When skivers were broken, the ends were dressed down for other uses, as observed in the upper row of plate 32.

FIG. 15.—Perforated bone object from Miller's Cave.

Shell spoons, knives, and scrapers were abundant. Some are shown in plate 37, along with perforated pottery disks and the bowl of a spoon made from the frontal bone of a deer.

Figure 16 represents the only adz or gouge form implement found. It is made of gray chert, the edge highly polished. In figure 17 is shown a broken clay pipe, identical in form and material with that in figure 14.

The red clay which had formed the floor of the excavated area from the mouth of the cavern to well past the central portion suddenly dipped to the north and to the east shortly before reaching the corner of the west wall. Attempts to follow it downward were frustrated by black earth, which when dug with pick or shovel assumed the consistency of "hog-wallow mud."

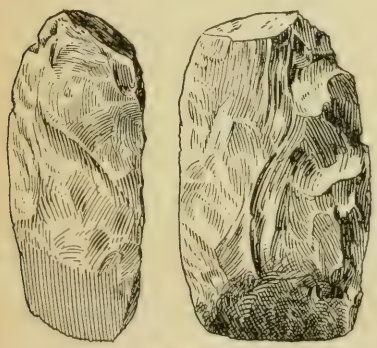


FIG. 16.—Adz or gouge of chert from Miller's Cave.

For a space of 4 or 5 feet inside the doorway, whose floor was about 3 feet higher than the average surface level in the cave, the ashes were not more than a foot thick, the clay rising to this extent. It spread out fan shape, with a continuous slope for several yards in every direction, thus making an easy grade for entrance and exit.

There are three ways in which this condition could have been brought about.

First, the aborigines may have constructed a graded way; though it is not at all likely they would have piled the clay so far to each side.

Secondly, it may have washed through the doorway from the outer cave when the main outlet of the latter in the face of the bluff toward *D* (fig. 13) was obstructed in some way. This is improbable.

Thirdly, it may be due to material deposited in the eddy or swirl created by the corner of the west wall whenever a large volume of drainage water flowed from the westward in the main cave and was sharply deflected toward the south when it struck the east wall. This is no doubt the correct explanation.

Whether or not these floods had any part in piling up the clay at the doorway, beyond doubt it was to them that the clay, gravel, and sand resting upon the floor of the main cave owe their origin. To them is likewise due the dark earth overlying the clay at the rear and covering the floor of the recess in the east wall. Clearly, there was at one time in the cave's history a current at intervals, which carried mud and small rocks from the interior of the cave, or from the outside surface through sink holes, and left at least a part of it where the velocity of the stream was checked. Later, much of this water found other drainage channels, and the coarser matter could no longer be carried into the cave; but at times of unusually heavy precipitation enough of the torrent followed the old course to bring in the dark earth. The last is due to top soil containing a large amount of humus from decaying vegetation. Finally, no more water came this way except as seepage, which is the condition at present.

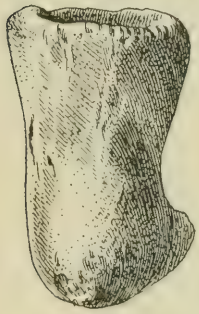


FIG. 17.—Clay pipe from Miller's Cave.

The pool at the rear may be entirely empty in dry seasons; and after heavy rains may contain a depth of 2 feet. This water now has a greasy looking scum and a sour, unpleasant odor.

The cave was inhabited before the water had entirely ceased to flow through it; this is proven by the alternation of refuse and silt in the recess under the east wall. Kitchen waste would be thrown here, and when the water rose sediment would cover it. There was then dry ground near the doorway; and the water in the pool, having an outlet toward the east, through the crevice, was fit for use, except, perhaps, when turbid.

On the rear slope, 18 feet from the water, the excavation was carried to the level of the bottom of the pool. The lower 2 feet was mud, and at the bottom water oozed in. Scattered through this muddy earth was much charcoal in small fragments; and for a short distance it also occurred for a few inches below the surface of

the red clay. This charcoal was carried in by the water at the same time as the earth with which it was associated, and must be due to fires on the hill outside. At any rate, it did not come from any fires made within the cavern. No refuse or worked objects of any kind were found in this black earth, except in the recess in the east wall, as described, and in the upper portion immediately under the ashes. Such as existed outside the recess may have become mixed in the same way; that is, by being thrown on the top as it existed at the moment and being later covered by the water; or it may have worked in from the ashes above. Nor was there much refuse in the ashes on the rear slope, although these were quite regularly stratified.

To entirely remove the rocks and clay and expose in a satisfactory manner the bedrock floor would require months of labor, the use of mechanical appliances, and complete drainage to the rear wall through the mouth of the cave.

Without attempting to make a detailed list, there may be given a summary of the objects shipped to the National Museum:

12 skulls, most of them more or less broken.
10 partial skeletons, including those of children.
8 fragments of skulls from different individuals not included in the above.
74 objects of shell.
711 worked flint objects; knives, scrapers, cores, etc.
10 grooved axes, tomahawks, and flint hammers.
10 mortars.
40 pestles, stone hammers, rubbing stones, etc.
413 wrought objects of bone and stag horn.
2 clay pipes.
1 box of pottery fragments.
A number of small objects, not classified.

There were left in the cavern several hundred broken flints; more than 60 mortars; probably 200 stones used as pestles, hammers, etc., and several large wagonloads of shell, bone, and broken pottery.

There is no way in which the age of the deposits in either the Miller or the Sells Cave can be determined. The accumulation of ashes in the one and of talus at the front of the other would certainly imply the lapse of several centuries, perhaps a thousand years of continuous occupation. Intermittent habitation would lengthen this period.

RAMSEY'S CAVE

Ramsey's Cave, better known as Freeman's Cave, is in a bluff on the right bank of Big Piney River, 3 miles below Miller's Cave. It is about 150 feet above the level of the stream and the same below the summit of the hill behind it. Within a hundred yards to east and west are shallow ravines by which access is fairly easy to a ledge

nearly on the same level as the cave; this is wide enough for one person to traverse, but in most places too narrow for two abreast. The talus in front is rough and steep but a crooked path with no difficult grades can be made to the water.

Chambers on each side near the entrance, which are accessible only by means of a ladder, provide excellent living quarters and command approach from any direction, even along the foot of the cliff on either side.

The entrance, which faces southwest, is a symmetrical arch 75 feet wide and 20 feet high.

Bedrock shows just in front, covered with loose material washed over the cliff. The floor ascends and the roof descends toward the rear, until at 70 feet they approach within 6 feet of each other; beyond this the cave is choked with fallen rocks and with earth and gravel probably from a sink hole some distance back on top of the hill.

Refuse shows about the entrance and for 40 feet toward the rear, where earth from the interior has worked down over it. The surface is strewn with rocks, large and small, so that excavations are possible only in small areas. Several holes were dug at intervals between the front and the rear; a considerable amount of ashes was found over the middle portion, thrown from still farther back. Very little was found in them. The rock bottom slopes upward slightly and was covered in some places with clay and gravel, on which lay the ashes and other refuse; these were nowhere more than 3 feet deep, and usually much thinner.

The place was so difficult to work in and the returns were so scanty that systematic investigation did not seem warranted, and the work was not extended. The only objects secured were a bone perforator, part of another one, a snail shell, apparently a bead, a very small piece of sandstone used as a grinder or polisher for bones, a fragment of worked mussel shell, and nine rough flints. There were also a few small fragments of pottery.

A man living near the cave reported that a few years ago he was digging in a narrow space between the east wall and a large fallen rock. He came upon the feet of two skeletons and took out the lower leg bones. Being assured by a friend that these were not bones of Indians because they were not "red," and so must be remains of white people, he replaced them and threw the earth back on them. He was certain the spot had never since been disturbed; but in this he was mistaken, for investigation revealed a pile of human bones lying in confusion, in which the frames of two individuals, as he had said, were mingled; but no trace of the skull or jaw of either. Evidently some one had come afterwards in search of the skulls. The femur of the larger individual was just 19 inches long; the other

frame was much smaller; but all other bones were in such fragmentary condition they could not be measured.

There is a rock shelter a short distance down the river from the Ramsey Cave and in the same ledge. It is 45 feet long, 15 feet deep, and 8 feet high in front, the roof coming down to the floor at the rear. There is nothing to show that it was ever used, even as a camping place.

A fourth of a mile above this cave is another from which flows a never-failing spring. There is a pile of ashes near the front, containing some refuse, but these mark only the site of an occasional camp, as the place could not be occupied in wet weather.

GRAHAM CAVE

On Graham's land, high up in a bluff facing Big Piney, opposite the mouth of Spring Creek, is a small cave difficult to reach and not suitable for occupancy.

PILLMAN'S, OR SPRING CREEK, CAVE (25)

At the mouth of Spring Creek, on land of John Pillman, near the top of the bluff, is a cave with an entrance 30 feet wide and 30 feet high. A steep rock ledge at the front offers an impassable obstacle to any stock except goats. The front chamber is well lighted for a distance of 80 feet, where it makes a turn. Bedrock is exposed near the entrance and rises toward the rear, showing here and there through the covering of earth, which is not more than 2 feet deep anywhere. Water cracks appear even in the highest spots, proving the floor to be saturated at times. There is considerable refuse inside the cave, but none in front, and it is reported that human skeletons have been found in it. If so they must have been on a ledge or in a crevice. Plate 2, *a*, shows the hill, from the west; plate 2, *b*, the entrance to the cave.

Two large cairns stood on top of the bluff above the cave. So far as can be determined in their dilapidated condition, there seems to have been a row of stones inclosing a definite area, but it is impossible to ascertain with certainty whether this was the case.

On a lower ridge, to the north, are three similar but smaller cairns. These are constructed entirely of sandstone slabs, and there was plainly some sort of system used in placing them; but, as in the case of the first, it can not now be determined whether there was a continuous wall, and, if so, whether it was more than one stone high.

A village site is reported in the river bottom on David Thomas's farm on the Big Piney, near Moab.

There were cairns, now totally destroyed, at two places on the ridge over which passes the road from Devil's Elbow to Spring Creek.

WOODLAND HOLLOW CAVE

A minor ravine, known as Woodland Hollow, opens into a small unnamed creek a mile above its junction with Big Piney River at the Devil's Elbow. In the west slope of this ravine is a large cave, named from its location. Through the middle part the floor is muddy; along the wall on the left, dry cave earth, with a width of 20 to 30 feet, extends for 70 feet from the entrance, its surface 4 feet above the level of the wet floor. A smaller amount of dry earth lies along the opposite wall. The sides of the cavern recede at the bottom, the dry earth passing under them. No estimate can be made as to the total depth of the deposits. At the mouth of a ground-hog burrow were two bone perforators, potsherds, fragments of bones, and pieces of worked flint, including two knives, which had been thrown out by the animal. Two mortar stones were found on the margin of the dry earth.

The cave belongs to Philip Becker, of St. Louis, who peremptorily refused to allow any examination whatever to be made; the only case in the whole region where cheerful permission was not given for any amount of excavation desired.

Three cairns, all demolished, stood on the Stuart property, half a mile from Woodland Cave.

There is a cairn on top of Lost Hill, half a mile south of Blue, or Shanghai, Spring on Big Piney.

WALLED GRAVES AT DEVIL'S ELBOW (26)

Three miles above the point at which it passes out of the hills into the bottom lands on its way to the Gasconade, the Big Piney River doubles on itself with an abrupt curve, which raftsmen have named "The Devil's Elbow." For more than a mile above and below this bend the stream flows in opposite directions in nearly parallel east and west channels around the foot of a spur from the high land to the west.

Into the Elbow, on its outer curve, three ravines from the east and southeast open within a fourth of a mile. They form the boundaries of two very narrow ridges or "hog-backs," which terminate in precipitous slopes near the river. For some distance back from the points the limestone bedrock crops out, a slight accumulation of earth in the crevices supporting a scanty covering of weeds but being insufficient to permit the growth of trees or bushes; hence the term "balds" by which they are locally known. The ridges have a gradual and nearly uniform slope toward the summit of the hill, which

lies half a mile to the eastward. The sandstone capping the hill appears within a few hundred feet and is covered with an abundant growth. On the upland are many large trees.

The ridge farthest south, on the farm of Joseph Ross, has five stone graves along the crest, numbered here in their order from the bluff. Number (1) is a few rods below the sandstone outcrop, and is constructed partly of weathered limestone blocks such as are now lying around it and partly of sandstone slabs carried from farther up the hill. All the other cairns, although (2) and (3) stand on the limestone bedrock, are built entirely of sandstone fragments ranging from the size of a brick or smaller to pieces weighing over 200 pounds.

At first sight the cairns appeared to be only piles of stones thrown together; but more careful inspection showed that each burial place was outlined by a wall, laid up with as much regularity as was practicable with the material at hand, and inclosing a space approximately square. Measuring from face to face of their walls, the spaces between these cairns were as follows: (1) to (2), 21 feet; (2) to (3), 19 feet; (3) to (4), 36 feet; (4) to (5), 34 feet.

Not one of these walls was intact at the time of examination; hunters had torn away portions of all of them in pursuit of small animals which had sought refuge among the stones; and such parts as were not thus injured were more or less displaced by roots of trees penetrating in every direction the soil which had accumulated in the open spaces.

So far as could be judged in their chaotic condition, the first step in their construction was to lay a row of slabs around the area required; then another row upon this; and the work was continued in this manner until the desired height was reached. As a rule, the stones were so laid as to break joints and to interlock at the corners, for greater stability; but in a few places this was not done. If a stone, once laid up, did not fit as it should, the builders apparently did not take the trouble to replace it with another better suited to the requirements. Seemingly, care was taken to build in such a manner that each outer face should be vertical, and in a straight line from corner to corner; but the inner side was left rough and irregular according to the shape and size of the blocks, no attempt being made to even it up. If timbers of any kind had been laid across the top, resting on the walls, there remained no indication of the fact. However, the bodies may have been protected at the time of interment by small vaults or pens constructed of poles, whose decay would allow the stones to settle, and of which no traces would now be left.

The space inclosed by the walls was filled with loose stones lying in such disorder as to suggest that they had been carelessly or hastily

thrown in to fill the interior and round up the top; but some of this confusion may have resulted from the same causes by which the walls were defaced.

It does not appear that any stones had been piled against the outside of the walls to assist in retaining them in place; such as were found in this position were either thrown there by the present inhabitants or had fallen from the top.

Two of the cairns, the second and the third in order, were so torn up and overgrown that no investigation of them was attempted; the three others were fully examined.

Cairn (1)

In the first, that nearest the terminus of the ridge, all stones lying against the outside of the structure were thrown aside, bringing the outer face into plain view. The inclosure thus revealed resembled the rude foundation of a small building. Measuring from corner to corner the north wall was 14 feet long, the south wall 16 feet, the east wall 14 feet, the west wall 13 feet. The walls were as straight and the corners as square as they could well be made with surface rocks not trimmed or dressed from their natural rough condition.

The space within was next freed of stones; the topmost were 3 feet above the outside level, though no doubt higher when first piled. The inside measurements were: North wall 10 feet, south wall 10 feet, east wall 9 feet, west wall 9 feet; all measurements being approximate, as no definite boundaries could be determined.

The south wall was practically destroyed; the others were not much injured, but no longer plumb, as they undoubtedly were when constructed. The east wall was in best condition; the outer face was nearly vertical; the top of the highest stone remaining in it was 28 inches above the bottom of the lowest. The general appearance of the wall indicates that it was somewhat higher.

After the stones were thrown out there remained a deposit of loose material, composed to some extent of very scanty soil and of humus from decayed weeds and leaves, but principally of disintegrated sandstone which had settled or washed in. Its thickness above bedrock was about 16 inches. All this was carefully examined.

Near the center, a few inches above the natural bedrock, were some fragments of human bones which seemed to belong to two adults. Another adult body, or skeleton, bundled or closely folded, had been placed against the south wall, which had partially fallen in on it. Pieces of long bones, including heads of two femurs, the ends of the bones at an elbow, phalanges, and a fragment of rib were found in a space less than a foot across. Nothing more of them remained and nothing else was found.

CAIRN (4)

The fourth grave in order was worked out in the same manner as the first. On the outer face the north wall measured 14 feet, the south wall 15½ feet, the east wall 16 feet, the west wall 14 feet. The interior lengths were: North wall 12 feet, south wall 11½ feet, east wall 12 feet, west wall 11 feet.

Near the center were a few fragments of bone, with a columella bead 4 inches long, perforated lengthwise. It is shown in figure 18. To the east of these, also to the south, were other fragments, indicating, in all, at least three interments.

FIG. 18.—Columella bead from Cairn (4), Devil's Elbow.

CAIRN (5)

In grave No. 5 the walls on the north and the south were entirely torn out except some stones in the bottom row of each; the upper portions of the east and the west walls were also gone. For this reason the rocks lying outside the structure were not removed.

The north wall, outside, was 15 feet long; the south wall, 14 feet; the east wall, 16 feet; the west wall, 14½ feet. The corresponding inner measurements were, north wall, 10 feet; south wall, 10 feet; east wall, 12 feet; west wall, 12 feet. But as the position of the corners was uncertain these figures are no doubt somewhat in error in either direction.

The central portion had never been disturbed, the stones lying as they were put originally, except for a possible settling due to their weight; the top of the rounded heap was about 4 feet high. This justified the hope that something might be discovered beneath them. But although the entire space within, up to the fairly defined inner faces of the walls, was thoroughly cleaned out down into the untouched gravelly subsoil, no trace of a bone or other indication of a burial was found. The only artificial object was a section 3¼ inches long of a columella perforated lengthwise, apparently lost by the wearer, as it lay on the natural surface. This is shown in figure 19.

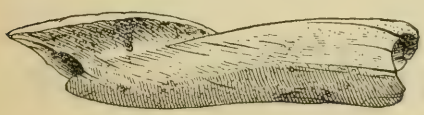


FIG. 19.—Columella bead from Cairn (5), Devil's Elbow.

CAIRNS ON HELM'S FARM

To the north of the Ross farm, on the ridge which is owned by Daniel Helm, are three stone graves made of shapeless limestone blocks such as cover the surface around them. One of these is about

300 yards from the bluff, on a knoll capped with the sandstone; the others are at the break of the ridge. All have been opened, two of them practically demolished. Those on the end of the ridge are only 14 feet apart, measuring from their adjacent margins, and were about 16 and 20 feet in diameter as built, both being somewhat widened now owing to the stones having been thrown outward from the central parts by hunters. Each was probably 3 feet high.

The smaller, being least defaced and nearly free from timber, was entirely removed, except a small portion along one margin, and the earth beneath it examined down to the bedrock. There was no sign of a wall; but one that would stand could not be made with stones rounded by weathering.

Remains of at least three bodies were found. One was laid in a crevice; only a few fragments of the long bones were left. With scraps of bone from another body were four teeth worn almost to the roots. They were not close together, but this was due to small burrowing animals which had scattered them. Of the third body, a few pieces of arm and leg bones remained. By itself, loose in the earth, was a single molar, not in the least worn, and with a very small root.

So far as appearances go, it seems the bodies were laid on outcropping rock, or in crevices, and stones piled on them without any attempt at order or arrangement.

The graves on the Helm farm are merely piles of stone, such as are found in various States. Those on the Ross place are of the same type as the cairns on Lost Hill at the mouth of Gourd Creek in Phelps County, but of a more advanced form. In both places flat stones were laid to inclose the burials. At Lost Hill, however, there was seldom more than a single layer, while at the Devil's Elbow a regular wall was built, seven superposed slabs being observed at one point with a certainty that others had been placed above these. They are not of the same class as the walled graves found in earth mounds along the Missouri River. In the latter, the inner face of the wall was as smooth and regular as it could be made, the outside being rough and upheld by stones and earth piled against them; while in those on Big Piney care was taken with the outer face which, it seems, was intended to be left exposed to view, while the inside was rough and hidden by stones thrown in. But no inference must be drawn from the different methods of filling or covering the vaults after they were completed. Along the Missouri, earth was abundant right at hand, but stones had, as a rule, to be carried some distance; while on the bluffs of the Gasconade and its tributaries the reverse was the case.

Petroglyphs, 75 feet above the level of the river bottom, are reported to be cut in a bluff facing the Gasconade River on the east side, 2 miles below the mouth of Big Piney.

A rock shelter not more than 15 feet wide and 10 feet deep is near the top of the bluff overlooking the Gasconade, almost opposite the mouth of Big Piney. It contains a quantity of ashes, but as it was frequently resorted to by bushwhackers during the Civil War, and is still much used by trappers and hunters who camp in it, these are probably not due to Indians.

ASH CAVE

So near to the county line that there is some uncertainty as to whether it lies in Pulaski or Phelps County is Ash Cave in a bluff over Baker's Lake, an artificial pond, 4 miles west of Arlington. The cave is small, and notwithstanding its name it contains no ashes or other remains of occupancy. The great number of large rocks on the floor makes examination impossible.

CLEMMENS CREEK CAVE (27)

At the head of a ravine opening into Clemmens Creek, about 4 miles south of Dixon, near the Piquet orchards, is a cavern with an entrance 55 feet wide and 40 feet high. The depth is 110 feet to loose rocks and clay, partly from the sides and roof, partly washed in through side caves and crevices. There is a small amount of cave earth along one wall, but it is damp, moldy, and covered with a growth of minute green fungus. Most of the floor, however, is of clay strewn with loose rocks and swept over by water at times.

There is no refuse, and the cave was never fit for habitation.

CAMDEN COUNTY

ALONG THE NIANGUA RIVER (28)

It is widely known that many caverns exist along the Niangua River and its tributaries, in Camden County, especially in the vicinity of Hahatonka, or, as it is locally termed, "Tonky." This is one of the show places of Missouri. The name includes a post office; a store; a school; an immense spring coming out at the foot of a cliff; the creek formed by this spring; a lake of several hundred acres, made by damming the creek; a picturesque ruined mill with the usual accessories of such a building; numerous caves; and a magnificent, but unfinished, residence crowning one of the hills. This has already called for an expenditure of half a million dollars; and at least double that sum, additional, will be required to complete it in ac-

cordance with the original plans. Whether it be due to the national appreciation of architectural beauty or the national appreciation of ability to do things in a large way, the palace seems to impress most visitors more than the remarkable combination of natural features.

The principal caves in the vicinity have distinctive names, as "Onyx" (there being two thus called), "Robbers'," "River" (this because there is a stream in it which can be crossed only in a boat), "Bridal," etc. Others are named for the owners of the land, or from some peculiarity, as "Dry," "Bunch," "Morgan," "Arnholdt." Many are not deemed of sufficient importance to have specific titles.

All those named were visited, as well as a number of the others.

A detailed description is not necessary. Not one of these caverns has ever been occupied unless as a temporary shelter. Some are flooded at intervals, either from the outside or by interior drainage; some have very restricted entrances and are dark at the front; some have rock floors or muddy bottoms; some can be entered only by clambering over talus to an opening at the bottom, or near the bottom, of a sink hole. Some shallow cavities, which under different conditions would be available as rock shelters, are in places difficult of access, remote from water, or otherwise unsuitable.

Some of these caverns have wonderful deposits on ceilings, walls, and floors, rivaling in beauty and ornate patterns those of the most famous caves of the country; and if they were easily accessible or could be conveniently explored, would attract hosts of visitors. One in particular, the "Bridal Cave," so called from a mass of stalactite material fully 10 feet from side to side at the top, which hangs in delicate translucent loops and folds and convolutions, equals Luray or Wyandotte for beauty, though not for extent.

It was reported that two walled graves stand on a "bald" on the farm of Will Robert Eidson, on the divide between the Niangua and the Little Niangua Rivers, about 4 miles north of Roach post office. They were described as "rocks laid up in a regular wall about 4 feet high, and about 30 steps square, and filled up inside with rocks." A visit to the site disclosed two ordinary cairns, made by throwing weathered limestone boulders into a rounded heap. Both piles have been scattered, and as they now exist one is about 25 feet, the other about 30 feet across. Such exaggerated, misleading descriptions are common, and result in much fruitless investigation.

Several caves are reported in the vicinity of Toronto, in Camden and Miller Counties; especially the Cokely Cave, 4 miles from Brumley on the Linn Creek road. From the descriptions given by informants, none of them appear to be suitable for habitation.

Many cairns exist on the ridges in this region, especially on high points overlooking valleys. All of them were built up with chert

or limestone blocks, and all are more or less torn up. So far as could be learned there is no sign of a wall in any of them.

In the present state of knowledge, Camden County offers no inducement for archeological research.

A FOSSIL CAVE (29)

The geological deposits in this region comprise three principal formations which are named in the State report as the Jefferson City limestone, the Roubidoux sandstone, and the Gasconade limestone. It is in the last (which is the lowest) that caverns are found.

In various places erosion, either internal or superficial, or both, has formed crevices or sink holes through which the disintegrated sandstone finds its way into caverns below, where it accumulates and hardens until more resistant than when in its original condition.

Further erosion has in several places carried away the limestone from around these intrusive masses, allowing them to project above the present surface. Sometimes, where the sand piled up, they resemble haystacks; but usually they are of indefinite form, having spread out on the floor of the cavern, as such material will do in a shallow stream.

An interesting example of this action is the "Standing Rock," 4 miles west of Linn Creek, the county seat. Here was formerly a large cave with an eastward trend until near the mouth, when it turned sharply southward, the opening being in the direction of a little stream. The lower end of this cave became solidly filled with sand, and the water found an outlet farther back. All the limestone which formed the roof and walls of the middle portion of the cave is gone, a narrow ravine marking its course. The sandstone obstruction held its place, and now extends directly across the ridge between the two ravines. Its surface is an exact cast of the interior of the cave which it filled, and nodules of chert, remaining when the limestone dissolved, are still imbedded in its surface. The line of demarkation between the limestone matrix, where this still exists in part, and the siliceous filling is as distinct as that between the stone and brick in a building. The loose cave earth shows plainly under the sandstone near the former mouth of the cavern. Plan and section are shown in figures 20 and 21.

MILLER COUNTY

WRIGHT CAVE (30)

A mile and a half west of Brumley, near Glaize Creek, is Wright, or Brumley, Cave. The entrance is 15 feet high and 40 feet wide.

At 20 feet from the mouth the width contracts to 20 feet. The depth is 120 feet in daylight to a stalagmite floor. Dry cave earth extends for 35 feet from the entrance, at which distance it reaches tough, sticky clay; this continues to the stalagmite. Above the clay are growing stalactites.

In front of the entrance were a few flint chips, but no indications of pottery or shell. A small implement, shown in figure 22, was

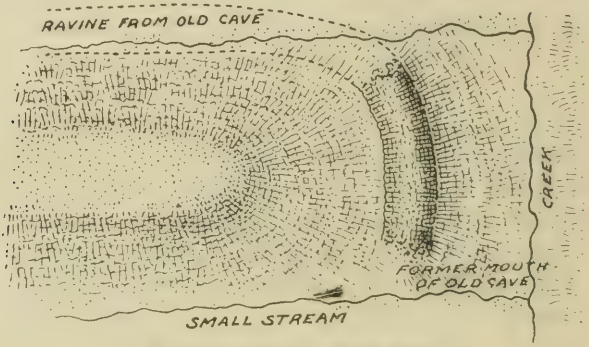


FIG. 20.—Plan of Fossil Cave.

found which is of interest because it was worked to a sharp point at one end of a narrow drill, while the other end widened into a squared form with a straight base which was dulled and polished from use as a cutting tool; the entire surface was polished from long service. An object of this kind would be highly suitable for mending moccasins and leggins. Finding this and nothing else strengthens

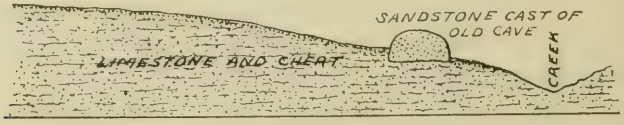


FIG. 21.—Section of Fossil Cave.

the probability that this cave was used as a temporary camping place, but was never permanently occupied.

WILSON CAVE (31)

Facing Barren Fork of Tavern Creek, on the farm of John R. Bond, 8 miles northwest of Iberia and 12 miles southeast of Tuscumbia, is a cave celebrated by reason of a provision in the will of a former eccentric owner.

There is a small cave which has an opening in the bluff, a few feet to one side of the larger cave. This can be reached only by means of ladders 60 feet long.

Jack Wilson came from Ireland and settled on Tavern (or Cavern) Creek in 1822. For a number of years he lived in this cave, with

his family. He died in 1855, leaving instructions that his body was to be packed in salt and placed in the small cave, "with a ten-gallon cask of good whisky," the entrance then to be sealed up. In order to carry out his last wishes, and at the same time to give him a "Christian burial," his wife had all his internal organs removed and interred in a cemetery; his body was filled with salt, and placed in a coffin, which, according to his wishes, was deposited in the cave, with the whisky. On the seventh anniversary of his death the whole community was to assemble to "eat, drink, and be merry." For many years residents in the vicinity had used the cave as a place for festive gatherings; but this occasion was to be on a scale beyond anything previously attempted. If necessary, Scriptural methods were to be employed; that is, messengers were to be sent out in all directions, urging every one to come. The floor was to be enlarged, and a platform erected on it. When all were assembled, the whisky and the coffin were to be brought from their resting place and set on the platform. Then certain famous fiddlers were to ascend the platform and play, while the guests danced. When the whisky was exhausted, and the fiddlers in the same condition, the picnic was over and the assembly would disperse. The coffin was then to be replaced in the little cave, which was to be again sealed up, not to be reopened until the Day of Judgment.

FIG. 22.—Perforator and knife from Wright Cave.

The preliminaries were carried out according to program, but when the time for the celebration came round the people were more concerned with the Civil War, and especially in the activities of the bushwhackers who infested that part of the country, than they were in picnics; and Wilson's resurrection was brought about by persons whose identity was never discovered. They got into his tomb in some manner, drank all the whisky, broke open the coffin, and threw Wilson's bones to the outside, where they were scattered down the slope. Horrified relatives gathered them up, replaced them in the cave, sealed it again, and Wilson is still there awaiting his final summons.

The entrance is 20 feet high and 45 feet wide. Dry cave earth extends for 135 feet; from this point it continues, partially filled with fallen rock and stalagmite, 40 feet farther, or 175 feet in all, in plain daylight, at which distance the cave makes a turn; and the cave earth was followed in this to complete darkness without coming to its termination.

Beginning 100 feet from the entrance and extending for 35 feet, a narrow row of loose rocks fallen from the outcrop of a stratum along the center of the roof lies on the surface. The cavern here measures 35 feet in width.

There is a wet weather stream along one wall, but the amount of water passing out is never large.

Solid bedrock, with patches of cave earth on it, is exposed, in slightly rising strata, for 10 feet from the little bluff at the mouth; within this it is hidden by the earth which gradually rises to a height of 6 feet; but some of this rise may be due to increased elevation of the rock floor. The entire cave can be easily cleared out to the stalagmite; and it would be advisable to remove at least portions of this in order to ascertain what may lie beneath it.

Refuse appears in considerable quantity in the bottom of the little stream bed and under the receding walls; and likewise a small amount outside the entrance. But the bedrock crops out frequently in narrow ledges between the mouth of the cavern and the foot of the hill, so very little débris of any kind lies on the slope outside.

Some alteration of the surface of the earth floor has taken place in consequence of the construction of platforms; but aside from this it has remained practically undisturbed.

BAGNELL CAVE (32)

A large cavern is near the top of the "Bagnell Hill" on the Bagnell and Linn Creek road, on the right (south) side of the Osage River, and about 3 miles from the town of Bagnell. On account of the "millions" of bats which shelter in it, the name of Bat Cave is applied to this as it is to many other caves in the region.

The entrance is so small that the cavern can be entered only by crawling in; and as no traces of Indian remains have ever been observed in it, or around the front, no examination was deemed necessary.

BODE CAVE (33)

Half a mile south of St. Elizabeth is the Ben Bode Cave. The roof has fallen in near the front, leaving the original exterior standing as a natural bridge a few feet wide. The present entrance to the cavern is 40 feet behind the bridge. It has a wet, rocky floor, and much water flows through it after a rain.

LUCKENHOFF CAVE

On John Luckenhoff's farm, three-fourths of a mile south of St. Elizabeth, facing Tavern Creek, is a small cave with a rocky floor. The entrance is nearly blocked with a mass of stalagmite, behind which the cave is dark.

JURGGENMEYER CAVE

It was reported that in a "cave" on the farm of Conrad Jurggenmeyer, 2½ miles east of St. Elizabeth, a human skull was discovered.

The statement may be true; but instead of a cave there is only a tunnel a few rods in length. Beyond the upper arch is an open ravine.

DAERHOFF CAVE

On Ben Daerhoff's farm, 4 miles north of St. Elizabeth, is a cavern facing a narrow valley through which a small stream flows to Tavern Creek a mile and a half away. The entrance is 8 feet high and 55 feet wide. It is well lighted to a depth of 120 feet, where it makes a turn. Dry earth extends back for 55 feet; from there on it is muddy. A small stream flows along one wall, from the wet portion of the floor to the entrance; with a little ditching this could be made to drain off all the water, forming a dry bottom to the rear wall. No refuse of any kind could be found, and the owner says he has never observed any either in the cave or in front of it.

CAVE NEAR MOUTH OF TAVERN CREEK

In the bluff facing Tavern Creek, half a mile above its junction with the Osage, is a cave with an entrance 10 feet high and the same in width. It has a depth of 45 feet in daylight. The floor is of clay and angular gravel, and so wet that puddles are found near the entrance.

BAT CAVE (34)

This is in a bluff facing the Osage, a mile south of the Rock Island Railway bridge. It is not accessible except by means of a ladder or stairway fully 60 feet long. The roof overhangs the entrance, and the floor projects over a shallow rock shelter which reaches for a few rods along the foot of the bluff. A small amount of water seeps from the entrance. Persons who explored the cavern years ago—there is no way to reach it at present—say it divides into three large chambers, mostly dry, and with floors of solid rock or of earth containing much rock.

GRAVE AT MOUTH OF SALINE CREEK (35)

Four miles below Tuscumbia, on the left bank of the Osage, is the mouth of Saline Creek which comes in from the north. On the lower (east) side of their junction, on the farm of Charles Tillman, is a low spur projecting toward the creek. On this is a pile of stones, all that remains of a vault or box grave which formerly existed there. Mr. Tillman says it was originally 35 or 40 feet across, a mound or rounded heap of stones, those about the top being larger than those nearer the base. Needing rock for various purposes, he procured them from this pile, beginning at the top to remove them and proceeding outward. In the course of this work

he found that a wall had been built up to a height of about 4 feet, forming a practically square inclosure. The space within was filled and the structure entirely covered with rocks of various sizes. He removed the stones as he reached them, and consequently did not notice whether the outer face of the wall was straighter or smoother than the inner face, or whether there was any particular difference. In all, he took away not less than 40 wagon loads of stones.

On the level top of the hill from which the spur extends is a village site, where mortars, pestles, quantities of flints, and much broken pottery have been found; but no shell.

STARK'S CAVE (36)

Six miles south of Eldon, on a farm now owned by George Irvin, is a cave which is continuous with a small ravine leading up to it. The entrance is 45 feet wide and 16 feet high; a small stream flows from it, along the foot of the left (northern) wall. This skirts a thin deposit of damp earth, which lies along the southern wall, gradually narrowing as it extends inward, until at 50 feet it runs out at the edge of a shallow pool reaching nearly across the cave. The bottom, except for the earth mentioned, is rocky.

The cave was never fit for occupancy.

HOUSE MOUNDS

In an old "History of Miller County" mention is made of a large group of small mounds on a certain man's farm, without giving the locality. It is believed by old residents that this man "lived at one time 2 or 3 miles west of Ullman." If they existed, they were no doubt house mounds.

CAIRNS

Several graves, in a group, were formerly on John Tillman's land, 6 miles south of Eugene. The stones have been entirely removed. When the ground was plowed bullets were found under the sites of the cairns.

MARIES COUNTY

INDIAN FORD CAVE (37)

This is a fourth of a mile up the river from the bridge crossing the Gasconade, 2½ miles east of Vienna. It is near the top of the hill at the head of a shallow ravine. The entrance, 35 feet wide, can be reached conveniently only near one wall, as a pile of talus immediately in front completely closes the opening; behind it the roof is 7 feet above the floor. If this accumulated material, which has in-

creased somewhat in height within the memory of men now living, were removed to the level of the floor, the main chamber would be amply lighted to its end, a distance of 150 feet. There is a gradual downward incline from front to rear, the floor sloping more rapidly than the roof. After hard rains some water runs into the cavern from the inner slope of the talus; otherwise the floor is perfectly dry for 65 feet, then becomes wet, and near the rear wall there is standing water. It is apparent that a former drainage outlet in this direction is now choked with sediment, brought down perhaps through a branch opening. At 25 feet within the entrance the cavern is 25 feet wide; at 65 feet the distance across is 35 feet, with both walls sloping away like a low-pitched roof and loose earth filling the space under them. At the rear wall the width between the two branches into which the cave divides is 40 to 50 feet. The floor here is clay, with numerous little puddles.

Some pottery, bone, and much shell, but no flint chips, are scattered on the floor and for 50 or 60 feet down the slope outside.

The cavern would make an excellent habitation and is well worth excavating.

LACKAYE'S BLUFF CAVE (38)

This is on the farm of Harrison Hutchinson, who lives 10 miles southeast of Freeburg, on the road to Paydown. It is near the top of a bluff facing the Gasconade. Talus has accumulated in the front part of the cavern until it rises within 2 feet of the roof; farther back the cavity is of sufficient height for a man to stand erect, although nowhere more than 10 feet wide. Owing to the talus the interior is in almost total darkness. Were this accumulation removed the roof at the entrance would be 8 or 9 feet above the floor. The cavern may have been occupied, but there are no indications of such fact, although the recent natural deposits may conceal some remains.

HURRICANE BLUFF CAVE

Half a mile below Lackaye Bluff, opposite the lower end of an island in the Gasconade, is a rock shelter 85 feet in length, 15 feet high in front, 6 feet high at the rear, and 15 feet deep along the middle portion, wedging out at either end. A large pile of talus in front forms a natural windbreak, and the depression is a favorite camping place with present-day hunters and fishermen. A small quantity of flint chips and many shells can be seen around the wall and for some distance down the slope in front. The site may repay investigation, though there is no great depth of earth.

It is reported that paintings of a deer or elk and other objects are to be seen on the face of a bluff near Paydown.

STRATMAN CAVE (39)

On the farm of Henry L. Stratman, 2½ miles above the Rock Island Railway bridge across the Gasconade River, is a cave near the top of a bluff facing the Gasconade. The entrance is 33 feet wide and 35 feet high. Forty feet back the walls approach each other, forming a doorway or short passage 5 feet wide. Beyond this is a room 18 feet deep and 9 feet across, with a rock ledge or shelf on each side several feet wide and elevated from a foot to 2 feet above the earth floor. This room is well lighted. The earth at the rear is 10 feet higher than at the main entrance. Behind this, in turn, nearly shut off by a large column of stalagmite, is a third room, 8 feet wide, whose earth floor rises rapidly. Were the stalagmite removed, there would be ample light for 20 or 30 feet farther, or about 90 feet in all.

Refuse, mostly shell, shows for 100 feet down the hill. There is some shell in the cave, along the walls; but most of the floor is a comparatively recent accumulation of roof dust and small fragments of rock, and is quite dry as far as light penetrates.

The entrance is much more easily reached from the top of the hill than from the foot of the bluff.

The trend and appearance of the reentrant side walls connecting the present entrance with the straight face of the cliff indicates that the earth in the cavern has a depth of 30 feet or more. Should this prove to be the case, here would be a most excellent place to search for evidence of occupation which, whether continuous or not, might bridge the time from the modern Indian to the earliest inhabitant.

Certainly no other cave in Missouri offers such facilities or inducements for careful and thorough investigation with a view to determining the existence of an early "cave man" in this country.

OSAGE COUNTY

RIVER CAVE (40)

This is at the foot of a bluff facing the Gasconade, 2½ miles below Gascondy. It has a solid rock bottom, rising steeply for a few feet within the entrance, and a constantly flowing stream covers half the space between the walls.

ROCK SHELTER

There is an excellent rock shelter, 50 feet long, over which the cliff projects for 15 feet, in front and to one side of the entrance of River Cave. On this is a slight depth of earth in which were found some broken bones and shells. The site is an excellent one for camping parties, but has no evidence of other than temporary use.

STEUFFER CAVE

Four miles east of Freeburg, in a ravine, is a cavern popularly known as Beer Cave, being formerly used as a storage room for beer made in a brewery built just in front of it. The entrance is 8 feet wide and 12 feet high. The front chamber, having practically the same dimensions, extends directly back for 50 feet, then makes a turn. The floor is a mixture of clay and angular gravel, with a continuous downward slope from front to rear. Water cracks show that it is sometimes flooded.

The place was never fit for living in.

CAIRNS

At the Gasconade River bridge, on the Rich Fountain road, two creeks on the west side, Brush and Swan, separated only by a narrow ridge which terminates abruptly at either end, come in a fourth of a mile apart. Both rise in the same lake, 6 miles from the river, and flow through parallel valleys, thus draining an abandoned ox-bow curve of the stream.

On the extreme eastern point of this ridge are two cairns. A fourth of a mile from these are two others; and farther back still more of them. All are now destroyed. They were the usual conical heaps of stone, 18 to 20 feet across

HOUSE MOUNDS (41)

A group of house mounds extends for half a mile eastward from Rich Fountain, along the valley of Brush Creek. They are fully 100 in number, and it is said there were formerly many more which are now leveled by cultivation. The ground is low, in some places swampy, so that water or mud surrounds many of them after a heavy rain.

"INDIAN FORT" (42)

This structure, also called the "Indian Lookout," is located on a bluff facing the Osage, half a mile below the "Painted Rock," and near the buildings of the Painted Rock Country Club, of Jefferson City.

Except for a slight projection or offset at one side, which contains an opening or doorway, it was practically identical in appearance with the vault graves along the Missouri River bluffs, described in Bureau of American Ethnology Bulletin 37; or else with those on Big Piney River in Pulaski County. It is formed of sandstone slabs, once laid up in a wall but now scattered in confusion as if fallen or thrown down. Apparently it measured about 32 to 35 feet outside and 12 or 13 feet inside.

COLE COUNTY

NATURAL BRIDGE CAVE

This is at the top of a bluff facing the Osage, one-half mile below the Rock Island bridge. It is only 10 feet wide and the same in height, and extends back 20 feet to a narrow passage which is almost closed by stalagmite. The site is difficult to reach, but disclosed a few fragments of pottery and some shell. The earth of the floor ascends rather steeply to the rear and contains many large rocks. It was only a camping place.

MORGAN COUNTY

SPEERS CAVE

On the Brown property, 7 miles southeast of Stover, is a reported cave, which proved to be a natural tunnel 400 feet long. The drainage from several farms passes through it from ravines above. The lower entrance is 40 feet wide and 50 feet high, the upper entrance 20 feet wide and 10 feet high.

Natural bridges and tunnels of varying lengths and widths are rather common in this part of the Osage Valley.

HOUSE MOUNDS (43)

Southeast of Stover, beginning at the edge of the town, is a group of house mounds extending over an area having a very irregular outline, but fully half a mile across in any direction. They vary from 20 to 35 feet in diameter and are scattered promiscuously at intervals of 25 to 150 feet. The surface on which they are built reaches over a succession of small knolls and ridges with slopes of 4 or 5 degrees. Most of them are along the sides of a wide, shallow valley draining northward, and of two or three small tributary depressions coming into it from either side, though a number are also to be found beyond the slight watershed which separates this drainage area from that to the southward. They exist in woods, meadows, and cultivated ground, so that some of them retain their original form, others are flattened and widened, while still others are barely traceable. Probably some have been entirely effaced by plow and harrow.

II. CAVE EXPLORATIONS IN OTHER STATES

INTRODUCTION

Certain conditions are to be taken into account in deciding whether a cave afforded a desirable permanent shelter to primitive man. It should be accessible; the floor should be dry, at least fairly level, and sufficiently free from large rocks to allow the inmates to move about freely; the entrance should be large enough to permit free passage and to light the interior to a distance that would insure protection from the elements. Temporary shelters or camping places might be deficient in some of these particulars and still be resorted to frequently; but if there were opportunity for choice, a man with intelligence to select a cave in which to live continually would, it is fair to assume, look for one possessing such features.

If such conditions, once established, were free from the mutations of time, the explorer would have but little difficulty in deciding upon a suitable site for his labors. But limestone, more than any other solid rock, is subject to constant erosion, crumbling, and falling; while the soil and loose fragments resulting from such action move downward year by year over the slopes and into any cavities where they can find their way. In the course of centuries the entire aspect of a cave may be so altered as to bear no resemblance whatever to its original appearance. Consequently a careful study must be made of the immediate surroundings, in order to determine what topographical changes may have occurred since the earliest time within which it is probable that man may have existed in that locality. Should the floor, at present, be of solid rock; or covered with only a slight layer of earth; or have a stream flowing over it; or show by marks upon the walls that it is subject to inundation either from adjacent streams or by surface water which finds its way in through sink holes; or be in such situation as to make it apparent that the original bottom was thus flooded in comparatively modern times, even though such may not now be the case—in any such event excavation would be labor wasted. On the other hand, all the necessary requirements for a convenient residence may now be present, and yet result from causes which have begun to operate within the historic period. In other words, there are very few cases in which the present appearance of a cave is to be deemed a certain or even an approximate indication of its actual state a few thousand years ago. There is

only one way to determine whether extended excavations may possibly result in satisfactory returns, and that is to sink shafts or run trenches in the superficial deposits.

INDIANA

The cave region of this State extends from Owen and Morgan Counties to the Ohio River. The caverns and sink holes gradually increase in number and size toward the south, until they culminate in Wyandotte Cave, second only to Mammoth Cave of Kentucky in extent, and in the so-called "valleys" of Harrison County which are in reality nothing but sink holes several square miles in extent. Some of the caverns are described in detail by W. S. Blatchley, the State geologist, in the Twenty-first Annual Report of the Survey (1896). Very few of those mentioned by him are at all suitable for permanent occupancy, though several would afford excellent shelter except in the rainy season, at which time most of them have the floors muddy or perhaps covered with water for weeks in succession. Such as were visited in these explorations will now be taken up in their order.

LAWRENCE COUNTY

Rock Ledge Quarry.—Early in 1903 periodicals mentioned an interesting discovery made at this place. According to the report, workmen in excavating a cut for a railway found an old cave entirely filled with stalagmite matter. In this, 10 feet below the former top of the cave—the cut did not extend to the bottom of the stalagmite—were discovered some bones which were pronounced by "several physicians" to be those of a human being. Among them was a "jaw tooth" (molar) and part of a skull. Correspondence failing to elicit any satisfactory information, a visit was made to the site. The cave could not be traced in either direction from the railway cut; but it had plainly served as an outlet for several large sink holes on the hill above it. Nothing could be learned here regarding the matter except that the objects had been found and were then in the museum of the State University at Bloomington. This place was next visited and the specimens inspected. There were many fragments still imbedded in the matrix, which was travertine rather than stalagmite. No exact determination of them had been made, but only casual inspection was needed to see that none of them could be human. The "jaw tooth" was from a peccary, the "human skull" was the carapace of a tortoise.

Shiloah Cave.—It was reported that, although the entrance to this cavern, 7 miles northwest of Bedford, was in a sink hole, the floor was level and accessible. The opening is almost at the bottom of the sink, whose slope is quite steep. After every rain the water

runs in; and while the floor is level, as stated, it has a constant stream of water flowing over it and is in absolute darkness.

DONNEHUE'S CAVE.—Although water flows continuously from the entrance, the amount of discharge was said to be small and the cave floor level and covered with earth, while the cave itself was large and well lighted. The approach, however, is quite difficult; the earth is nowhere more than 2 or 3 feet thick, and after a heavy rain the stream extends from wall to wall.

Between Bedford and Donnehue's cave is one, unnamed, at the head of a ravine which was once an extension of the cavern. The opening is of fair size but the floor is of rock and the outflow of water is steady.

Just outside the corporate limits of Bedford, to the south, is an opening in the cliff at the head of a deep ravine, more in the nature of a rock house than of a cave. It would make an excellent shelter for a few persons, being accessible, protected from winds, and close to water. While it may have been so used formerly, the deposit of earth and stone on the floor is very scanty and anything beneath could well be quite modern.

Two caves were reported 2 miles south of Bedford. One is a small opening from which a stream issues, flows across a meadow, and enters the other cave, which is much larger. They are parts of one passage, the roof between these openings having broken down, and the stream is the same which finds its outlet at Donnehue's cave.

Several other caves in the vicinity of Bedford were visited. They are all small and of no importance from an archeological standpoint.

DONNELSON'S CAVE.—"The mouth of the cave is found at the head of a deep gorge worn through the limestone by a good-sized stream which flows from the cave and down the gorge to the broader valley beyond. Many centuries ago the cave extended the full length of the gorge, and the waters of the stream flowed directly from its mouth into the valley. The roof of the underground channel finally became so thin that it collapsed, the gorge was then started, and as the centuries went by grew in length, the cave becoming ever shorter by the continued falling of the roof.

"Three passages open directly into the mouth of the cave. The right hand passage has the level of its floor about 5 feet above that of the entrance, while the opening on the left is 12 feet above the level of the stream and very difficult to enter without a ladder. The middle passage extends straight back from the common vestibule or main entry. The latter is 25 feet long, 21 feet high, and 18 feet wide, but at its farther end is reduced to the narrow middle passage between great masses of limestone. The water in this passage is waist deep and explorations must be made by wading or in a light

canoe. One hundred feet within is a magnificent cascade, where the stream rushes and leaps down a narrow passage with such violence that the noise is plainly heard at the entrance.

"The right-hand passage for the first 100 feet is about 10 feet high by 15 wide, with a clay bottom and a roof on a level with that of the vestibule. It then expands into a large room, 230 feet long and 40 feet wide, which lies east and west at right angles to the entering passage. This narrows at the west end to 20 feet, and at one point the outer air flows in through a small opening in the roof. From near the small end of the room a narrow passage starts off to the southward and can be traveled for 200 feet, when it becomes too small for further advance. Along this passage a small stream flows, disappearing through a hole in the floor near the entrance to the larger room. Other than this, both right and left passages leaving the main entry are dry.

"The passage at the left of the main entrance to the cave is about 150 feet long by 20 broad, and contains no points of especial interest." [W. S. Blatchley.]

It may be added to the above description that a heavy rain causes a rapid rise of several feet in the stream through the middle passage.

The cavern is situated 3½ miles east of Mitchell. It has been fitted up by the State University as an experiment station for the study of underground fauna and flora.

The branch to the right is never entirely dry. Throughout the year water trickles or seeps over the stones and keeps the mud soft and sloppy, while after extremely heavy rains the water may be 2 or 3 inches deep for a short time—enough to keep all the earth washed from the floor for 50 or 60 feet from the entrance.

The northern or left branch presented a smooth, solid floor of rock at the beginning. The roof is about 13 feet above the floor, being a flat stratum broken by a joint-seam along which there is a slight fault. A ledge of friable sandstone 3½ feet thick lies next below the roof. The disintegration of this gave a dry covering to the clayey earth which covered the floor almost to the extreme edge of the rock overhanging the stream and gradually rose toward the rear, where it entirely filled the space from floor to roof. The distance between the side walls is 8 feet at the mouth. They diverge slightly, and at 65 feet are about 12 feet apart. Here they separate more sharply, forming a chamber 30 feet in diameter, measuring on every side to the contact of the earth and the roof. At the extreme rear a slight wash or depression in the earth revealed the top of a vertical solid wall, thus marking the limit of the cave in that direction. It seems, however, to extend farther to the east and the west than it can now be followed: in fact, the indications are that at one time a considerable cross-cavern extended along this line.

The work of clearing out this branch began at the entrance. The superincumbent earth was removed by a trench whose boundary was the solid rock on each side until the cave widened to more than 8 feet between the walls; then a width of 7 to 9 feet was excavated midway between the sides, the entire trench having a length of 92 feet, or reaching nearly to the vertical wall at the rear. For about 60 feet the earth was removed to the rock floor. At this distance the floor dipped. The bottom of the trench continued to follow the same level it had held to this point, in the belief that the dip in the floor was due to a crevice or slight erosion channel and would soon disappear, bringing the rock to its normal position. This was not the case; several holes were dug, the deepest one 3 feet, into the mingled clay and rock, without finding any evidence of a solid bottom. The conclusion seemed certain that the passage leading from the entrance of the cave to the large room at its farther end was only a tributary or branch of a cross-cave extending in an east and west direction, as intimated above. Prof. Eigenmann, of the State university, reached the same conclusion through surveys not connected with this work. Under the circumstances further digging seemed useless; for if this should be a cross-cave the bottom would probably, almost certainly, be on a level with the stream now flowing through the central passage, while if it should prove to be only a cellar-like deepening, it would not be utilized for a habitation.

At 30 feet from the entrance the accumulated earth had a thickness of 6 feet; from there it rose gradually to the roof at the end.

At 37 feet, in a pocket of coarse sand on the rock floor, such as settles in a gentle current, were four fragments of bone. There is not enough of them to identify with certainty, but they seem to belong to a deer, a turkey, and some bird about the size of a quail.

At 66 feet in, a foot lower than the surface of the bedrock (being 5 or 6 feet beyond the above-mentioned dip), were small fragments or particles of charcoal, or what had every appearance of such. They were in earth that showed the lamination or stratification due to successive water deposits, and had been introduced in the same manner. The entire earth deposit below the sand capping showed this lamination, sometimes horizontal, sometimes curved, proving a long period of deposition. Further evidence of age is found in the travertine, 7 inches thick, that occurs on top of the earth at the back of the cave.

In the absence of all other evidence the specks of charcoal can not be accepted as proof of human life in the vicinity at the time these deposits were forming.

While the work was in progress three students from the university came through the central cave in a small boat, having entered through a sink hole 3 miles away in an air line. At some point of their course

they lost their lanterns and made the remainder of the journey in absolute darkness, feeling their way along the walls, dragging or carrying the craft over shallows, and at one place lying flat in the bottom and propelling the boat by applying hands and feet to the roof, which was less than a foot above the water.

MARTIN COUNTY

Various caves are reported in the vicinity of Shoals. Those whose location was clearly given are merely "rock houses" or recesses in the Carboniferous conglomerate bluffs bordering the east fork of White River. Some of them would make fairly good shelters, but all which can now be examined are at so low a level that the river gets into them or very close to them in flood periods. Consequently there is no probability that ancient remains are to be found in them. Some of the shelters higher up on the cliffs may have been utilized, but the bottom of these is now covered with huge blocks, some weighing a hundred tons. It is true that such rock houses, in all parts of the country, were regular resorts for modern Indians, and they probably furnished shelter to the earliest inhabitants of this region, no matter how remote the period of occupation. But owing to their open front and the exposed situation of most of them, it is quite possible that the wind may remove the fine material falling from roof and sides almost as fast as it is deposited. At any rate the débris on the floors is seldom more than 3 or 4 feet deep, and articles very plainly of no great age are frequently found at all levels in it.

In a few places along the river bluffs limestone crops out beneath the sandstone, and springs occasionally appear along the line of junction, eroding small cavities, but these are subject to overflow, and none of them has an opening large enough to enter without crawling.

ORANGE COUNTY

Vicinity of Paoli.—From this town six caves were visited, all that could be located by diligent inquiry. None of them has any particular designation except "Mill Cave," which is so named because the stream issuing from it furnishes power for a flour mill. The water covers the floor at all seasons.

One, though quite small, could have been occupied at a former period, but the roof and front fell in some years ago, entirely closing it.

A third has a small entrance on a hillside. A steep and rough descent was followed beyond reach of daylight without coming to a level bottom.

The other three are very small with rock bottoms.

French Lick Springs.—Two or three miles from this place is "Star Cavern," which is advertised as being of great size and beauty. The immediate surroundings are quite romantic and deserve the praise accorded the spot by visitors. The cave itself, however, more resembles an artificial tunnel than a natural result of erosion. The floor is clean rock with a little brook flowing over it.

Two other caves not far from Star Cave are dry, but with solid rock floors, so they were not visited.

Orangeville.—Near this place are the so-called Gulfs of Lost River. The stream sinks a few miles east of Orleans, emerges at the "Gulfs" from one side of a very large sink hole with precipitous margin, and immediately goes out of sight again in a deep pool or chasm. It reappears a mile or so away at the foot of a cliff where, after heavy rains, it boils up like a gigantic fountain. Numerous small caves or sink holes exist in the neighborhood, three of which were reported as being dry, lighted, having good entrances, and well suited for habitancy. One of them is at the bottom of a sink hole on a hill. The descent is steep and rocky for 20 feet (it was not followed farther) and no doubt so continues to the level of the river which flows almost directly under it.

The two others are in the principal "Gulf." They are open and of good size, but mud high on the walls shows they are filled with water in wet seasons.

CRAWFORD COUNTY

Marengo Cave.—This is growing famous as it becomes better known. Blatchley says that in it "are probably crowded more beautiful formations of crystalline limestone than in any other known cave of similar size in the United States." Visitors who have been in both say it surpasses Luray Cavern in the magnificence of its sheets and columns of deposited material.

As it was not opened until 1883, and the bottom can be reached only by a stairway 60 feet high, it was of course unknown to the aborigines.

A small cave near Marengo has an opening on a hillside, and can be directly entered from the outside; but it is at times a passageway for a strong current of water 3 feet deep and extending the full width of the cavity.

Milltown.—A mile north of the town is a large cave which would furnish an abode for scores of people. The entrance is in a slight depression on the level upland west of Blue River. The descent is down an easy slope of fallen rock and earth about 30 feet deep to a rock floor. Beyond the foot of the slope there is a slight thickness of earth, so that explorations could reveal nothing that had a certainty of antiquity.

There is presented here a fine example of the manner in which caves of this character become exposed to the upper world. At first, there was an underground channel draining the adjacent country over a territory of varying extent, sometimes many square miles. At some point the roof fell in more rapidly than in other parts, until at last it became so thin as to give way entirely. If the débris was not sufficient in amount to extend above that part of the roof which remained intact on either side, so that it would be gradually carried away, the cave would remain open in both directions, as is the case at the "Gulfs" just described and at other caves statements of which appear in subsequent pages. Usually the débris quite chokes up one side and all the superficial drainage is turned into the other, which is thus kept open. In time, the slope around the depression becomes tolerably uniform except close to the entrance, and there is no outward indication that the cave ever extended farther than the spot where the new entrance is located. So the cave, as it is now open to examination, is only a portion of the original passage, and as the explorer pursues his way, he may be going toward either the former mouth or the source. In the former case, he comes out of a large opening, or what was formerly such, on some slope in the neighborhood, or descends until his way is obstructed by water. In the latter, he may find his way shut off by diminishing passages, or he may descend to lower levels through newer drainage channels cut by the streams which have been reversed and forced to carve other outlets for themselves.

This change occurred in the Milltown Cave a very long time ago. Standing on the débris, several feet within the entrance and beneath a part of the roof now perfectly dry and showing no marks of percolating water, is a stalagmite 31 inches in diameter, which has weathered to a depth of 3 to 4 inches from atmospheric influences alone.

Wyandotte Cave.—So much has been printed concerning this celebrated cavern that no mention need be made of its interior features. The place seems excellently adapted as a habitation for primitive people. It is situated on a hill at whose foot is the bank of Blue River. Five miles away, as the road runs, is the Ohio. The backwater sometimes reaches up the tributary for more than 10 miles. The flint-bearing stratum of the Harrison County aboriginal quarries outcrops a short distance away and appears at several points within the cave. The country is extremely rugged, and good springs occur frequently. Game was formerly abundant in the hills, and Blue River still rewards the angler with various species of fish, many of them of large size.

A former race, presumably the modern Indian, did much work within the cave. Tons of travertine or stalagmite, the so-called ala-

baster, have been quarried from some of the deposits, while a large number of flint nodules has been dug out of the cave-earth where they fell from the disintegrating limestone. Some of this labor was carried on more than a mile from daylight.

The mouth of the cave was formerly almost closed by a mass of talus. About 10 feet has been removed from the top of this, so that one may now walk in without difficulty. On the inner side of the portion remaining there is a slope for 96 feet, to a vertical depth of a little more than 27 feet. The next 100 feet gives a descent of about 3 feet; then another steep slope begins. The first point at which bedrock floor is found within the cave is 120 feet lower than the point of entry. It is supposed that the drainage to which the cave owes its origin was outward; if this was the case the floor must be more than 120 feet below the roof at the doorway. While this may be true, it is not indicated by the condition of the visible strata. For about 50 feet outward the side walls are nearly parallel and nowhere more than 30 feet apart. Then they terminate at an angle in the outcrop of the ledge along the hillside. The appearance and condition of the upper strata, together with this narrow separation of the side walls outside the cave, produce the impression that at a period not very remote the roof of the cavern reached to the outcropping ledge in which the walls end. Even though the rock floor should be at the great depth supposed there is a possibility that an earth floor could be found below the detritus which has accumulated since the roof fell in or has worn away.

To test the matter a shaft was begun at a point 16 feet in front of the doorway. This was as near as such work could be done without interfering with the advent of visitors, and allowed a margin of 30 feet toward the outer slope. The shaft, 6 feet in diameter, soon passed into a compact mass of red clay filled with rocks of various sizes. At 14 feet down this was broken by an irregular stratum averaging a foot in thickness, of coarse sand or fine gravel with a slight admixture of clay, such as would form in a running stream. Its slope was inward or toward the cave. As there are sandstone ledges on the hillside above, this sand may have come from them, but, if so, it is singular that none appeared elsewhere. At 18 feet down was a mass of travertine measuring nearly 3 feet across and from 6 to 12 inches thick. It had formed around the lower part of a stalagmite 18 inches long, and the bottom of the whole formation rested horizontally on clay. This gave the excavators hope that an earth floor had been reached, as the stalagmite was vertical and resembled in all respects stalagmites in the cave. But it was soon found to be a foreign inclusion, and the same confused mixture of clay and stone continued below as above. Various fragments of stalactites and stalagmites were found as part of the detri-

tus. These, especially the vertical one, seem to confirm the supposition that the roof reached out this far at a period which is quite recent as compared with the age of the cave.

To a depth of 25 or 26 feet the task of excavating was as tedious and difficult as digging up a much-traveled, rocky road, the earth being dry enough to scour the shovels. Then the earth grew moist and within 2 feet was muddy. Cavities appeared, into some of which a switch could be thrust 3 or 4 feet. Where such a cavity extended under a large stone, stalactites were in process of formation. Soon the earth began to work into a soft mud under the feet of the workmen, and at 32 feet particles and small clods were noticed falling from the sides of the shaft. A foot lower this breaking away became more decided. It may have been due merely to the loose condition of the wet earth allowing unsupported portions to fall from the freshly exposed surface, but there was also the risk that the softer earth was sliding under the weight of that above. The workmen, two of whom were experienced well and cistern diggers, declared the risk too great and demanded to be brought to the surface.

The depth reached by this shaft was at least 5 feet lower than at any point inside, within 200 feet of the mouth of the cave. The material, with the exception of the sand layer, was almost identical from top to bottom, there being no apparent difference other than increase of moisture in the lower part. The only explanation suggesting itself at present is that the chasm is filled with large loose rocks up to a point near the bottom of the shaft; that débris from the hillside above has covered these more rapidly than it could settle in the crevices and cavities among them; and that water which makes its way downward finds some obstruction to its free passage out at the bottom of the chasm.

The only safe plan of excavation seems to require the removal of all the earth between the side walls to a depth below the mud. If the rock bottom, or any solid bottom, is at a depth of 120 feet, there is small chance that man lived in this region at a time when it was easily accessible.

Saltpeter Cave.—This is about 600 yards northwest of Wyandotte Cave. "The entrance, in a side of a ravine, is 5 feet high and 19 feet wide. Once within, a gigantic room expands, 220 feet long, 75 feet wide, and 10 to 30 feet in height, with smooth flat ceiling and earthen floor, the latter descending and with its edges much encumbered with fallen rock." [W. S. Blatchley.]

From the description given, this would seem an ideal site for research. Unfortunately, the bottom of the ravine is not more than 5 feet lower than the top of the talus at the entrance. This slight

elevation is the only barrier which keeps the surface water from flowing in, and while the ravine seldom has any water in it, there would be enough after a moderate rain to drown out the diggers who were working below its level if the bank were removed.

LITTLE WYANDOTTE.—This, like three caves on Blue River above Wyandotte, four in the vicinity of Leavenworth, and one on the opposite side of the river in Meade County, Ky., has a small entrance in solid rock, with a steep and narrow passage to the foot of a slope which does not expand into a room of any size until at some distance beyond daylight.

HARRISON COUNTY

The only cave of any note in Harrison County is at the King quarries, 5 miles east of Corydon. It has two outlets, one at the foot of a little cliff, through which a fine spring has an exit; the other in the face of the cliff, about 10 feet higher and a little to one side. The latter discharges more or less water after every rain. The drainage of several large sink holes is through the two openings. The owner says mud has accumulated to a depth of 3 feet on the floor within his remembrance, due to cultivation around the sink holes, which causes the soil to waste.

ILLINOIS

MONROE COUNTY

MAMMOTH CAVE.—The so-called "Mammoth Cave of Illinois" is near Burksville, in Monroe County. An opportunity was afforded to visit it while engaged in the cave work. It is very extensive, according to the owner's description, being "7 or 8 miles long." The mouth is at the bottom of a sink hole, and the cave is now reached by a narrow stairway 40 feet high. Formerly it was necessary to clamber down the walls, stepping from ledge to ledge with a foot and a hand on either side. Then a ladder was made, said to have been 50 feet long; and, with more frequent visitors, the stairway followed. The crevice is very short, a mere crack, apparently made by water working its way down from the bottom of the sink. All the drainage within the rim goes into the cave, and it accumulates in the rainy season until the floor is covered. A farmer living near says he has seen the water from the cave rise until it covered the bottom of the sink hole. As similar depressions are numerous in the vicinity, probably the combined inflow is greater than the cave can carry away. The floor has been leveled and a close pavement of large slabs laid over the muddy portions. No one has ever heard of human remains being found anywhere in the cave.

KENTUCKY

Crossing the Ohio River from the southern Indiana cave region, the counties of Kentucky lying in the belt of lower Carboniferous limestone were next visited. No cave that seemed worth examining could be heard of above the extreme southern portion of Hardin County. The sections examined will be taken in their geographical order from north to south.

HARDIN COUNTY

Hutchins or Bradley Cave.—This is in the bluff bordering on the left bank of Nolin River, 2 miles west of Upton. It was reported that human remains had been found in it. The present owners, who have known the cave for a long time, never heard of any such finds. The entrance is low and narrow, so that access to the cave is to be had only by creeping several yards. The cavern then expands into a very large chamber, separated into three by curtains or partitions of stalactites and stalagmites. Very little of floor, roof, or walls is to be seen, being almost entirely covered by secondary deposits. Some of these are remarkable for size and beauty. There is no probability that the cave was ever inhabited.

Saltpeter Cave.—This is 3 miles southwest of Upton. It has a large entrance and an earth floor, but the dirt has all been worked over for making saltpeter, so there is nothing to search for.

HART COUNTY

Laird's Cave.—About 2 miles north of Northtown is a large, roomy cave, with a good entrance, but water drips from all parts of the ceiling, and the floor is muddy and rocky. The drainage from 3 or 4 acres of hillside flows over the arch of the entrance and logs 6 inches in diameter are carried into it by the surface floods.

Lock's Cave.—This is a mile east of Rowlett's Station, near the top of a ridge, and lying nearly parallel with its crest. It affords another instance of a cave which has come to light only after a portion of its roof has fallen in. The detritus entirely conceals the opening at one end. The other end is entered by going down the fallen rocks over a slope of 15 or 20 feet, which leads to a bottom strewn with rocks. In such cases there can be nothing under the loose material, because the cave had no entrance until this had fallen in.

Garvin Cave.—This cavern, which is 3 miles southeast of Munfordville, has an opening at the bottom of a sink hole, requiring a rope or ladder for descent.

Harlow Cave.—This is 3½ miles southeast of Munfordville. It is a very large cave, apparently, as the slope down the débris is more

than 40 feet high, to a rocky shelf, beyond which the descent was followed some yards without finding any indications that a level bottom was near. It is another illustration of the fallen roof.

WYNNE'S CAVE.—Three miles south of Rowlett's Station is a large sink hole. Stones thrown into the vertical shaft at the bottom can be heard striking the sides for three or four seconds before coming to rest.

WASH. ROWLETT CAVE.—On "the old Lewis Martin place," 1½ miles west of Rowlett's Station, a section of roof, 20 or 25 feet across, has dropped into a deep cavity. The sides are still insecure. The descent to a spring under what appears to be the original roof is somewhat more than 40 feet. The ceiling is not more than 6 feet high.

STEFFY'S CAVE.—Four miles southwest of Munfordville between 200 and 300 feet in length of the roof of a high and wide cave has fallen in. Ice remains in this cave until May or later every year.

JOEL BUCKNER'S CAVE.—About 10 miles northeast of Munfordville is a large cave with the entrance on a hillside. The roof has evidently extended several rods farther out than at present. The front part of the cavern is wide and high, but is now nearly filled with débris. The roof slopes at about the same angle as loose material within, there being not more than 3 feet of space between the two at any place nearer than 30 feet from the present mouth. Rocks thrown back showed the same uniformity of slope to continue at least several yards and the depth there to be about 20 feet below the top of the detritus at the mouth. This cave was suitable as a habitation before the material now choking the mouth had accumulated, provided water was obtainable. The nearest spring now is more than a mile away. An exploration would require, as a preliminary, the removal of several hundred cubic yards of compacted rocks and clay.

HARRY BUCKNER CAVE.—Half a mile north of the cavern last named is another with a very narrow entrance. The floor, which slopes downward, is solid rock in part, and the place is not adapted for occupancy.

CUB RUN CAVE.—Cub Run is a little settlement 12 miles west of Munfordville, near the Edmonson County line and about equidistant from Green River and Nolin River. Two miles in a direct line south of the village is a cave or rock shelter which has much local notoriety from the fact that three skeletons were found in it. They were imbedded in mixed ashes and earth and accompanied with several pestles, bone perforators, three flint knives, a small celt, and part of a clay pipe stem. One of the skeletons was that of a child not more than 8 or 10 years old. It has been pronounced the frame of a white

child on account of the shape of the skull, but is more probably Indian, as the three were found together. Two of the bodies had been laid side by side; the other was near their feet at a right angle to them. In the back of the child's head is an incision somewhat over an inch long. The skull is slightly fractured downward from one end of this cut, and the corner or angle thus formed in the bone is pressed outward.

A flint implement found almost in contact with the skull fits closely into the aperture and may have produced it, as the form of the wound could have been thus caused.

The cavity or chamber of this cavern is about 100 feet across in each direction. There is a small opening near the back which has been examined to a distance of 75 or 80 feet, being there obstructed by large blocks of sandstone similar to those which fill the space from floor to ceiling along the back end of the shelter.

There is another very large block just at the entrance, in which are one shallow and two deep circular depressions which were probably mortars. Bones of deer, bear, and other animals have been found within a foot or two of the surface both outside and inside of the cave. Contrary to what is usual in sandstone cavities of this sort, the outside earth slopes upward from the entrance and after heavy rains considerable water flows into the cave. This makes the earth on the floor quite sticky at times, although it is mainly sand, containing very little clay.

The skeletons were found at a depth of about 16 inches, close to the side wall. A small trench dug where they were unearthed showed, in succession, a layer of ashes 4 or 5 inches thick and not more than 3 feet across, a foot below the surface of the floor; a few inches of earth; a layer of ashes an inch thick, at two feet; below this, yellowish undisturbed sand, apparently fallen from the sandstone roof, and continuing to the rock floor, which was about 32 inches below the top.

Another trench was dug about midway across the cave and the same distance from the front as the skeletons were found. This was on or close to the line of heaviest drainage into the cave and the earth was so wet as to be very sticky. A few little patches of what appeared to be ashes but which had not resulted from fires made on the spot, three or four broken mussel shells, and a chip of flint were found in the first 18 or 20 inches. More than this amount of earth could easily have washed in since they were left here by modern Indians. Below this level the earth contained not the slightest object of human origin, to the rock floor which was found at a depth of 6 feet. On the rock was nearly pure sand, probably the result of disintegration; some clay lay on this; then the mixed loam, sand, and clay composing the outside soil.

It would appear that this cave was utilized as a place of shelter at irregular intervals by Indians in tolerably recent times; that at least

one of those found, perhaps all three, had died or been killed during a somewhat protracted sojourn; and that only a slight covering of earth, if any at all, had been placed over them.

Two similar caves are within 8 or 10 miles, but were not visited.

EDMONSON COUNTY

MAMMOTH CAVE.—For miles from the entrance saltpeter workers have dug down to a level where the amount of loose rock rendered further excavation too expensive. In many places walls of stone are piled against the sides of the cavern. They were among the earth that was removed and have been so piled to get them out of the way.

As far back as "Chief City," 3 miles from the mouth of the cave, the floor is littered with fragments of canes (reeds) and saplings, which, from the appearance of the ends, were broken, twisted, or bruised off with blunt tools like stone hatchets. Most of those remaining are lying on massive loose rocks now forming the floor, though the ends of some are seen projecting from beneath stones much larger than two men can lift. It is possible the latter have recently slid or slipped from higher up the slopes, but the indications are that they have dropped from the roof since the time of these early explorers. If this be the case, it points to a considerable antiquity for the remains, because no such downfalls are known to have occurred since the cave was first explored by white men.

So much work has been done about the entrance of late years for improving the approaches that excavation would be useless, even if allowed, unless carried to a depth of more than 20 feet. Such work would greatly interfere with the plans of the management.

WHITE'S CAVE.—This is about three-fourths of a mile from Mammoth Cave. The entrance, quite small, is near the crest of a ridge, and the floor descends abruptly. Only a narrow chamber exists within reach of daylight, and the cave is wet all the time a short distance back.

COLOSSAL CAVE.—It is said to be 4 miles from Mammoth Cave, but is really only a little more than 2 miles. The present entrance is entirely artificial, the descent to the floor being about 120 feet. The original entrance was in a crevice which explorers descended by means of ropes. It is said that another entrance is known to one man who, however, has to crawl a long distance.

SALT CAVE.—This is 4 miles from Mammoth Cave, though belonging to the same company. The entrance is at the bottom of a conical sink hole draining about an acre. Not much water runs into the cave from this cause, as the surface slopes outward from the margin except on one side, where a ridge leads to the hills. A spring which comes out near the top of the sink falls over a ledge at the bottom

into the entrance to the cave. It is said that this water soaks into the ground within a few rods and that just beyond are large, dry rooms, well adapted for habitation, which formerly contained many evidences of aboriginal occupation. Exploration is impossible now, as the entrance was effectually closed some years ago by throwing in logs, brush, rocks, and earth, in order to protect the formations from relic hunters. The water from the spring falls directly on and flows into this, and can not now be turned aside. Even if it could, all excavated material would have to be carried up a steep slope and deposited in the field surrounding the sink hole.

Dixon's Cave.—It is supposed, with good reason, that this was at one time connected with Mammoth Cave. It can be easily entered, through a large crevice, where the surface rock has fallen in. Approach to the bottom is down a steep and rugged slope of about 60 feet vertically. Within, no earth is visible, it having been entirely removed by saltpeter miners, who left the rocks piled in great rows from side to side across the cavern.

Mammal Cave.—This is so named because a tusk was formerly exhibited at the hotel which was reported to have come from here. It was afterwards learned that the specimen was imported from another State. The cave is small and damp, not suitable for living or even for stopping in.

Proctor's Cave.—This is 6 miles from Mammoth Cave. The present entrance is artificial and so far as could be learned the cave is a recent discovery.

Haunted Cave.—The name is given to commemorate the fact that human bones were found in it. Physicians, it is said, pronounced them bones of a white person. The cave, which is on Green River, some miles below Mammoth Cave, was not visited, as the entrance is described as a crevice through which a man has difficulty in squeezing his way, while the interior is nowhere more than 8 feet wide. The cave soon connects with another narrow vertical crevice which reaches the surface at the top of a ridge.

Briggs's Cave.—About 6 miles west of Cave City, and 4 miles west of north from Glasgow Junction, is a cave on land of Ike Briggs, which was described as fit for habitation. Its entrance is in a small sink hole, on a hillside. The approach is easy, and entry not difficult; but the cave receives the drainage of several acres and the floor is always muddy.

Poyner's Cave.—This is a mile east of Briggs's. While a large cave, the entrance is at the foot of a sink hole an acre in area. It is necessary to stoop for some distance on entering, and the bottom here is rough and wet. Farther in it is dry and roomy—so much so, that people in the neighborhood use one chamber as a "ballroom." This part is some distance beyond daylight. As in all caves which

are entered from a sink, it would be very difficult to dispose of any excavated earth, as it would have to be carried up the steep slope to the outside.

SHORT CAVE.—Chaumont is a station on the road to Mammoth Cave, 3 miles from the Glasgow Junction. The cavern, which is so named from its limited extent as compared with Mammoth, is a mile from the station. The entrance, reached by a winding way along the ridges, is on one side of an irregular depression comprising 3 or 4 acres. At present there is a heavy bank of earth, several feet high, across the entrance, nearly closing it to the top, except at the middle where a wagon road has been cut through to allow fertilizers for mushroom beds to be hauled in. This earth, so it is stated, was not there when the cave was discovered, but has been carried from the interior partly by saltpeter workers, and partly by the present owner in order to cover up some rocks and to make the floor smooth and level. In front of the cave and of the earth piled at the entrance is a level space of 25 or 30 feet to a deep sink hole. Some water and mud, in time of wet weather, runs into the front part of the cave but its effect is not noticeable for more than 30 or 40 feet. Beyond this is a reach of more than 200 feet of perfectly dry level floor. It was not so smooth before some grading was done for the mushroom beds, but was at no time rugged or difficult to travel over. At 300 feet from the entrance is a slope about 20 feet high, at the foot of which begins another floor so dry as to be dusty in places. Whether this apparent thickness of 20 feet is of earth, or earth and stone mixed, or is indicative of a dip in the rock floor, is not known, as no excavation has ever been made except for the plant beds. There is a slight descent, not more than 3 or 4 feet, from the entrance to the point where the flood water seems to reach. This is seemingly due altogether to the wash. The width of the cave is about 50 feet, and notwithstanding the partial closure of the entrance there is sufficient light as far back as 200 feet to enable one to read ordinary print. So there is ample room within reach of daylight for several hundred people to gather without inconvenience.

The owner, Capt. J. B. Briggs, who lives in Russellville, has granted permission to make any excavations desired, provided the floor be left in good shape when done. It is evident that any satisfactory examination will demand a large expenditure. If only a preliminary trench were made, the necessary slope would require a considerable width at top, while if anything should be disclosed that called for extensive research, the earth must be wheeled or otherwise removed to the sink hole in front, and the whole floor brought to a nearly uniform level.

So far as appearances go, this cavern is better adapted for occupancy than any other which has been examined. The depth of earth shows it to have been open for a long period. If nothing can be found here, denoting extreme antiquity of man, it would seem useless to make further search in central or western Kentucky.

Bear Creek.—A very large rock house is on the right bank of Bear Creek, 3 miles above its mouth. It would afford good shelter to a large number of people, except in rainy seasons when they were most in need of it. After heavy storms the creek covers the entire floor.

Other rock-shelters exist along Green River above and below Bear Creek. They are not worth investigating. Some are flooded; others difficult of access; still others become muddy after rains; while in none of them is there any great depth of earth.

WARREN COUNTY

Crump's Cave.—A mile north of Smith's Grove is a large sink hole, from one side of which extends a cave nearly a mile long. There is abundant room and a good light near the front, and it is reported that quantities of ashes were formerly to be seen on the earth a short distance in. A considerable outside area drains into the cave, and the floor at the present time is everywhere so wet as to be quite muddy. Much water also falls from the roof. A hydraulic ram, not far from the entrance, formerly forced water from one of these falls to the farm residence. A descent of 6 feet, over large rocks and wet earth, brings one to the nearly level floor, 40 feet from the mouth. The amount of flood water running into the cave is indicated by a gully 4 feet deep and the same in width, while trash and driftwood litter the floor from wall to wall for more than a hundred yards.

Thomas Cave.—This is a mile north of Bowling Green. The roof of a cavern has fallen in and forms a high mound of rocky débris, down which a path winds on each side, giving access toward either end of the cavern. There is scarcely a possibility that it was ever occupied.

Mill Cave.—Three miles south of Bowling Green a stream emerges from the foot of a slope, flows a hundred yards through a canyon-like open channel, and disappears under a cliff. This is another instance of an open cave due to a falling roof. The open end is large and forms an excellent shelter for cattle. On either side of the stream, under the cliff, is a shelf or projecting ledge, covered with loose stones. Neither is 2 feet higher than the water level in a wet season.

BARREN COUNTY

PAYNE CAVE.—This, also known as Saltpeter Cave, is near Temple Hill, 9 miles southeast of Glasgow. The bluff in which it is situated is a conglomerate limestone, rising from the waters of Skagg's Creek. The cave has three different entrances, 100 feet or more apart, and each entrance is broken into three or four by columns or masses of stone that have resisted erosion. None of the entrances is large, or opens into spacious chambers within daylight. Flood marks are visible in all, and it is said that after prolonged or heavy spring rains the water covers the floors.

BEN SMITH'S CAVE.—This was discovered while digging out a fox den. It is a tunnel-like cavity, not more than 6 feet high or wide, and not suitable for habitation. It lies a mile and a half south of Temple Hill.

FORD'S CAVE.—This is between Freedom and Mount Hermon, about 14 miles southeast of Glasgow. Originally the entrance was about 8 feet high and 20 feet wide, and opened into a well-lighted chamber probably 40 feet wide and 60 feet long. The floor was of earth and level, with ample space between it and the roof, as shown by marks on the walls, for people to move about readily in any part of the room. The entrance is now artificially closed by earth and stone, except for a space 4 feet square in which a door is hung. Old men in the neighborhood claim they can remember when the floor was 20 feet lower than at present; a manifest impossibility, for that measure would bring it several feet lower than the bed of Mill Creek just in front of the cave. They also claim that blocks of conglomerate and travertine 5 to 10 feet in each dimension have formed from "drip" within their recollection; which, if true, would prove these persons to be almost contemporaneous with the cave men. The more probable statement is also made by them that in early days saltpeter workers dug up and leached all the earth in the cave, filling the entrance and the narrow space before it with the leached earth from the front part of the cave and throwing that from farther back into the cavities and pits left by the prior workings. Inside the cave, near the entrance, is a never-failing spring whose waters flow through a short, narrow crevice at one side. While easily accessible, the water does not reach any of the earth floor.

This would have been an excellent site for aboriginal residence, but there is now no undisturbed earth within daylight nor for some distance beyond, and no one can remember that anything of an artificial nature was ever exhumed.

THE ESMITH CAVES.—Two caves situated on Peters Creek near Dry Fork post office, 14 miles southeast of Glasgow, were reported to be admirably suited for shelter purposes. The smaller is not more

than a foot high, from floor to roof, and is filled with flood water after every heavy rain. The larger is above flood line, but the entrance is not over 2 feet high, and the "cave" is scarcely sufficient for a sheep shelter. If the floor were cleared off to a depth of 4 feet from its present level, it would be covered whenever the creek reached high-water mark.

Bone Cave.—Five miles east of Glasgow human bones were found in a cavern. Particulars could not be obtained. The cave is on a hillside and is entered through a narrow crevice by straddling the walls or going down a ladder. Rocks and trash form a mound in this, the top being 15 feet below the outside surface. On either side of this mound one can make his way continuously downward to darkness, and a rock thrown ahead can be heard going on down some distance over loose stones. If human bones were ever found in here, either they were thrown in or some person fell in and was unable to escape.

Slick Rock Cave.—This is near the post office of Slick Rock, 7 miles east of Glasgow. The entrance is in a narrow crevice at the brow of a low hill. The descent is steep and rugged to beyond daylight.

Love's Cave.—This is located on Dr. Love's farm, 3 miles north of Slick Rock. It is now used for storing apples and potatoes. The entrance is through a large sink hole, formed by the falling in of the roof of a cave which was at least 50 feet wide at this point. As is usual, the débris has blocked the cave in one direction. Descent is regular, though steep, along the slope into the other end of the cave. The floor is wet and muddy the entire year on account of the drip from roof and overhanging rock at the mouth. The vertical distance from top of the débris to the level floor is about 30 feet, and from the top to the outer surface about 20 feet more. Any attempt at excavation would be difficult and costly, and conditions are such as to make it probably fruitless.

MONROE COUNTY

Four caves in this county were represented as being worth investigation. All are north of Tompkinsville, the county seat.

(1) A rock house in the conglomerate sandstone on the land of Dr. E. E. Palmer, 7 miles north of Tompkinsville, shows smoke stains on the ceiling, and some flint chips among the gravel and earth in front where they have been exposed by water dripping over the face of the cliff. There is, however, only 2 to 4 feet of space between the earth floor and the roof, across the cave from side to side, a distance of 20 feet, and from the front to a point 10 feet back. From this rear portion the earth slopes downward, parallel with the roof of the cave, to the wall behind. The amount of descent could not be

accurately ascertained owing to the cramped space, but seems to be 5 or 6 feet. At about that level on the outside a ledge was found on both sides of the entrance and appears to continue across. If so, the earth covers the part immediately in front of the cave. Neither tools nor men could be found to do any trenching, but it is not probable the shelter was ever high enough for a man to stand erect in, because most, or all, of the floor earth must have come from the ceiling.

(2) A mile north of Dr. Palmer's is the McCreary Cave. The entrance is from 60 to 70 feet across and the cavern reaches back fully a hundred feet without any diminution of breadth. Two branches then start under the hill. Each has been explored more than a mile. From each branch flows a considerable brook. They unite near the entrance, sink into the floor, and reappear as a strong spring 30 feet lower in the ravine leading from the cave. The earth is not more than 3 feet deep near the front. It becomes greater in amount farther back, but is wet everywhere below the level of the running water, consequently no excavation was practicable. Flood marks show that the whole floor, except in places a strip along the side walls, is completely submerged at times. On one side a rock ledge or shelf above reach of the water is covered with dry loose earth from 1 to 3 feet deep. This has been dug up in nearly every part by treasure seekers, but nothing of human workmanship has ever been found.

(3) The Belcher Cave is 7 miles northwest of Tompkinsville. It is also called Mill Cave, because a gristmill near the foot of the hill below it is run by the outflowing stream. The entrance is wide and high; the front chamber or vault is fully a hundred feet across each way. But the bedrock is exposed in places and the earth is not more than 2 feet thick anywhere. Water from the brook percolating through this keeps the lower portion saturated.

(4) On John Black Tuley's land, on Meshach Creek, 6 miles northeast of Tompkinsville, two human skeletons were found in a small opening, which has since been known as the Bone Cave. It is a room not over 10 feet across at any part, in a limestone conglomerate, and may be of quite recent origin. Being inconvenient of access, it is not in a position for residence purposes. The skeletons, which were less than 2 feet below the surface, were probably those of Indian hunters. The material in which the little cave is formed will crumble easily in cold weather, being rather wet from the soil water soaking through the hill above it.

There are other caves in this county, but from the descriptions they do not seem at all suited even for temporary camping needs.

LOGAN COUNTY

Very little limestone appears in Logan County, the surface rock being mostly conglomerate. A reconnoissance was made here, however, from Russellville to Diamond Springs, to investigate "a broad valley" which was reported to extend in a general north and south direction from the Ohio, near Brandenburg, toward the Cumberland. It was also claimed that beds of drift gravel exist at a considerable elevation above the little creek now flowing through the valley and that rock shelters are numerous at various levels.

As there is an abandoned drainage system, different from the present, somewhere in this part of Kentucky, which has never been traced, the place seemed worth a visit. The result was disappointing.

The valley is due entirely to causes now at work. The gravel beds result from weathering of lower Coal Measure conglomerates. The rock shelters are shallow, or with a thin covering of earth on the floor, or subject to overflow. None was found that offered any incentive for examination.

TODD COUNTY

On the farm of Mr. Robert Glover, 3½ miles southwest of Trenton, is a cave known generally as "Bell's Cave," from a former owner. This forms the outlet of a large sink hole, all the rainfall of 6 or 8 acres draining out through it. The entrance is wide and deep, with an easy descent to the level floor. It was for a long time a shelter for Indians, for there is a layer of ashes more than 6 feet in depth, 50 or 60 feet long, and about 15 or 20 feet wide. These represent the probable original dimensions, but the top has been leveled for a dancing floor, and the drainage water has cut away a large part of it, depositing the material farther back in the cave. Six feet of vertical face is exposed at one place by the water, but the ashes extend still deeper. It is said that bone needles, animal bones, antlers, mussel shells ("different from any in the creek now"), burnt rock, and much broken pottery were found in leveling the top. A very fine polished flint celt 12 inches or more in length is also reported. One human skeleton has been found, either at the edge of the ash bed or a few feet away from the edge. The floor is covered, where the earth is washed off, with flint nodules and fragments, and the slopes outside have considerable on the surface. The gullies washed along the slope are paved with nodules like a macadamized road, and in a few places the streams have cut into them so as to show a foot or more at the lower part of the bank so filled and packed with nodules that a knife blade could not be thrust in more than 2 or 3 inches. But there is no evidence of aboriginal quarrying. Probably the

Indians dug nodules out of the gullies, for chips are found above and on each side of the mouth of the cave.

To the west, on top of the hill in which the sink hole occurs, and beginning at its edge, is an aboriginal cemetery. There are two small mounds and numerous graves. Scores of the latter have been opened. They are all alike; flat stones form bottom, ends, sides, and top. Many have only one skeleton; others more. The greatest number yet found in one was six. Few are more than a foot deep or much over 5 feet long. About one in ten contains relics of some sort—in two or three entire pots, beads, arrowheads, and gorgets occurred.

I opened three; two contained one body each. The face of one was down, but all the other bones of this and all the bones in the second grave were so decayed that no statement of their position can be made. In the third grave, which was 2½ feet deep—the deepest yet found—were three bodies. Two lay with faces north; the other, behind these, with face south. The grave was 24 inches wide and less than 6 feet long. Most skeletons (it is reported) were doubled up; often the graves were not over 3 feet long and 10 to 16 inches wide. In some the bones denoted skeleton burial. One skull had been perforated by a ball; at least there was a round hole on each side exactly such as would have been produced by a bullet.

Another large cemetery is on the farm of Mr. G. S. Wood, next north of Glover's. Mr. Wood has opened 50 or more graves and found some relics.

Flint arrows, spears, knives, drills, hoes, spades, and celts, not to mention unfinished pieces, have been found by the thousand on the surface within a mile radius of these cemeteries.

It would seem useless to make any further examination of the level limestone region of central or southern Kentucky. Nearly all the minor drainage is underground, and most of the caves have inlets through sink holes or in small crevices. The water supply is scanty except along streams, and in such situations the caves are usually, for various reasons, of such character as to preclude a continuous occupation, or one extending to a very ancient date. Search is more likely to be rewarded in the mountains where an ample water supply is always at hand.

TENNESSEE

MONTGOMERY COUNTY

DUNBAR'S CAVE.—Three miles east of Clarksville a large cave has been fitted up as a summer resort. The earth has been leveled around the entrance, both inside and outside, floors laid for picnics and other gatherings, booths, refreshment stands, and places of

amusement erected and the surrounding grounds somewhat improved. On account of all this, the place has become quite noted. At present there is from 15 to 20 feet of loose stones and earth on the solid rock floor, and a strong stream makes its way beneath them. It could never have been occupied in prehistoric times until the débris had practically reached the stage at which it was found by the whites.

INDIAN MOUND CAVE.—A report was received to the effect that the mouth of a cave on the Stewart County line, about 18 miles west of Clarksville, had been closed by a rock wall, and earth piled against the outside of the wall; also, that tool marks are quite distinct in a chamber which is plainly of artificial origin.

The rock wall is the stratified rock, in place; the earth in front has washed down from the hillside; the tool marks are water channelings; and other remarkable things mentioned in the report are equally natural. The entrance is a narrow crevice.

SULLIVAN COUNTY

LINVILLE CAVE.—This is 4 miles almost directly west of Bluff City. Apparently it is of great extent, for large sink holes connected with it are scattered over an area of several hundred acres. There are three principal openings. The largest is near the top of a knoll or low hill, and is due to the falling in of the roof. The sunken part has an area of about 30 by 60 feet. Usually, in such cases, the débris entirely fills one end of the cavity thus made, obscuring that part of the cavern, the other end being kept open by surface drainage. In this case, owing to the dip of the strata—some 8 or 10 degrees—and to a change in direction of the cavern at this point, both ends may be entered from the fallen rocks and earth. At one side the descent is precipitous and winding, over and among large fallen rocks. No level place is reached in daylight. At the other side the descent follows the natural dip of the strata and no level space can be found from which the entrance is visible. This part, also, is filled with rocks, large and small, from the roof and sides, and was never habitable.

Fifty yards from the main entrance is another much smaller cave, on the slope of the knoll. It is at the bottom of a crevice 10 feet deep. The floor is level, but only a few square yards in extent, the sloping roof reaching it within 10 feet. As there is considerable drainage into the cavity from the hillside, it is probable that this floor, at least the upper portion, is of recent origin, and that the earth extends downward indefinitely toward the subterranean stream.

West of the knoll on which these openings are found is a valley 2 or 3 miles long. Timber shuts off the view toward its head. This

is drained by a constant stream which after winding from side to side of the little vale flows under the knoll. The hole where it disappears is small, but as no rock floor is visible it may lead into a large cavern, and there is no doubt that all the sink holes in the vicinity as well as the two openings above described eventually have the same outlet. Excavations would be difficult and useless.

THOMAS CAVE.—In the face of a steep hillside, near the south (left) bank of the Holston, 3 miles east of Bluff City, is a room with a nearly level floor 10 by 18 feet in the longest measurements. A narrow passage, high enough for a man to walk in, branches off to the right but soon begins to diminish in size and at 100 feet becomes too small to crawl through. The débris in front of the cave is piled to a height of 16 feet above the present floor, and the highest floods of the river reach to about the same level on the outside. The rapid disappearance of the surface water which finds its way in indicates an underground passage to the river, so that a solid floor would not probably be reached above the ordinary water level.

ARKLOW CAVE.—This is a mile and a half southeast of Bluff City. It was reported to have a level earth floor, not more than 4 feet below the accumulation outside. While this was formerly the case, cultivation of the hills around now causes a great amount of surface water to flow over the little bluff into which the cave opens, and this has carried nearly all of the loose earth away through some underground channel. The descent for upward of 30 feet is steep and rugged; it was not traced farther.

MORRELL CAVE.—On the south side of the Holston River, 2½ miles east of Bluff City, lies the farm of E. S. Worley. Except for a narrow strip of river bottom land, the surface is broken and rocky, the highest point being some 400 feet above the stream. Beginning near the brow of the river hill the central portion of the farm is in a depression whose very irregular rim or watershed surrounds an area of more than 100 acres. All the water that falls within this space drains into a sink hole the bottom of which is but little above flood stage of the Holston. On the south side of this sink is a vertical bluff 120 feet high, from whose foot emerges a stream that after a winding course of 50 or 60 yards disappears in a small opening on the east side of the sink hole, and finally comes to the surface at the foot of the hill, near the river. Its volume is sufficient, even in time of severest drought, to turn the undershot wheel of a large mill. The course of the stream above the point where it is first visible is through a cave which has been traced to the foot of the Holston Mountains, 3 miles away, and there are many unexplored branches. Chambers are known with a cross measure of 100 feet or more, and some of them have a height nearly as great. Stalactites and stalagmites, some of them possessing unusual size and beauty, are abundant.

The sink hole is due to the falling in of the roof of the cave, which could no doubt be followed to the river if it were free from obstructions in this direction.

North of west from the mouth of the cave is another opening, partly in the same strata but 40 feet higher, the dip of the rock being 10 or 12 degrees to the southeast. This was so blocked with talus which had fallen from the cliff and washed down the side of the sink hole that it was necessary to creep nearly 40 feet from the entrance, down a moderate slope, before coming to a point where it was possible to stand upright. From here progress to the junction of the two caves, about half a mile from the entrance, is easy except where fallen rocks interfere somewhat.

Early in the Civil War a large amount of saltpeter was manufactured here. A dam was constructed just within the mouth of the main cave, and in the pool thus formed boats were used to transport the material from the interior. The workmen not required for handling the craft usually preferred to walk through the upper cave to the place where the earth was procured.

The combination of natural features at this place is unusually favorable to aboriginal habitation. The main cave is excluded from consideration by reason of the stream filling it from wall to wall after very heavy rains. The upper cave, however, showed, beyond the débris choking the entrance, a level floor, cumbered, it is true, by fallen rocks, but apparently quite suitable for a dwelling place were these removed. Although opening toward the north, its position so far below the summits of the surrounding hills protects it from winter winds. The creek assures an ample supply of clear cold water. Mountains, refuge for game, are in sight in various directions, while the Holston River is less than a quarter of a mile away.

In order to remove the débris a point 3 feet below the lowest spot on the floor was selected on the slope outside. From here a trench was carried in on a level, the additional depth being taken to facilitate clearing away all material that had accumulated inside the cavern in comparatively recent time, and thus lighten the task of deeper excavations should these be required. The trench needed to be only wide enough at the bottom to allow room for running a wheelbarrow, but owing to the great amount of broken rock, loosely held together by a small quantity of earth, the sides continually gave way, so that by the time it was safe to pass through the trench was 25 feet wide at the top and 24 feet deep at the mouth of the cave. The rocks were of every size from small pebbles to blocks weighing more than a ton each.

Nothing whatever of artificial character, not even a flint chip or fragment of charcoal, was unearthed until at a point 4 feet inside the farthest projecting stratum of the roof. Here was found a pre-

historic stone wall whose outer side and top had been entirely concealed by débris. On the inner side the upper portion was visible, owing to the fact that the owner had gathered a quantity of loose stones to construct a wall farther down the slope. Previous to this the ancient wall was entirely covered by the detritus, and even after this partial exposure its true nature was not suspected. It was about 6 feet high, built up of rocks of various sizes and shapes loosely fitted together, earth from the outside surface being used to level up in places where the stones would not bind properly. The largest rock in the top layer weighed about 800 pounds.

The horizontal distance between the top of the wall as it was when cleared off and the corresponding portion of the cave roof was 4 feet; to the roof directly above it, about 2 feet. Apparently it had at one time entirely closed the entrance; at the western end where it abutted against the solid rock the upper portion was firmly consolidated by travertine. Directly above it, nearly 2 feet higher, a slab and some small irregular fragments were securely attached to the side and roof by the same agency. A crevice in the bedrock just at the end of the artificial wall contained several wagonloads of small rocks which had been thrown into it. These also were united into a solid mass by the travertine, all of which had been deposited by water flowing through the crevice. It does not follow that the wall was ever higher toward the opposite end than at this time. In the centuries that have elapsed since it was put up, the roof at the front of the cave, being rather thin-bedded, may have disintegrated. It was not possible to uncover the wall in shape for illustrating; portions of it continually crumbled as the looser material piled against it was removed.

From the wall inward the foreign material piled against the west side of the cave was composed almost entirely of small rocks, with scarcely any earth, and so compactly bound with travertine and stalagmite as to resist all attempts to remove it by ordinary means. On the east side—the left as the cave is entered—there was a great variation in the size of the stones; they were intermixed with much loose dry earth, and there was scarcely any "drip-formation" in the mass. The removal of all this disclosed a projection of solid rock forming a shelf from 8 to 12 feet wide, whose top was about 2 feet higher than the bottom of our trench. About 20 feet from the ancient wall the trench reached the original bottom of the cave as the latter was left by the stream to which its origin was due. This was the tough red or yellow clay, filled with water-worn stones such as appear in all gullies or ravines in this region. It contained a small quantity of stalagmitic material here and there and gradually rose until at 20 feet farther, or 40 feet from the old wall, it terminated against solid bedrock, reaching across the cave, the entire width of which at this point was 26 feet. The shelf on the left belonged to the same stratum,

This brought the work to the terminus that had been the aim from the first, namely, the lowest level of the floor, which was thus shown to be only a foot above the solid rock instead of at least 10 or 12 feet as the general appearance of the entrance and its surroundings had indicated. It was completely cleaned off as far as this was possible, but within 3 feet of the end of the trench began a mass several feet in thickness of fragmentary rocks of every size up to 20 tons or more which had fallen from the roof and were bound together by stalagmite.

Altogether, more than 300 cubic yards of material were removed. The workmen had been carefully instructed as to what the search was for, and kept a close lookout, as evidenced by the very small objects they were continually offering for inspection. It is safe to say that not a spadeful of earth missed scrutiny; but, aside from the artificial wall, the only traces of human presence were three valves of mussels, a turkey bone rudely pointed for use as a perforator, and three or four bones which seem to have been subjected to fire. Not a chip of flint or other stone showing work, no ashes or charcoal, not a piece of pottery, were discovered. If aboriginal burials were made in the cave—and the wall is almost definite proof of such fact—they are either on the floor under stalagmite or in crevices now concealed by fallen rocks.

Numerous small fragments of animal bones were found scattered singly at all depths in the material removed. Nearly every one showed marks of the teeth of rodents. According to Prof. F. A. Lucas, of the National Museum, they all belong to modern species except one tooth, which is that of the cave tapir, and (possibly) the jaw of an otter.

BLEDSOE COUNTY

College Cave.—About three-fourths of a mile west from the old Sequatchie College is a cave which was described as the largest in the county, and as the only one in which people might ever have lived. The opening is about 5 feet wide and 4 feet high; and from it comes a stream sufficient to run a mill.

No other caves could be located in this county or in the Sequatchie Valley north of it.

SEQUATCHIE COUNTY

Lakey's Cave.—In the foothills of the Cumberland Plateau, about 5 miles southeast of Dunlap, the county seat, is the largest cave in the county. A great quantity of earth and rock has accumulated in front of the entrance, washed from the mountain side over an area

of several acres. Formerly most of the surface drainage carrying this down flowed into the cave, thus keeping a passageway open through which a man could crawl. Ditches have recently been cut to turn away the water, the entrance walled up, a solid door hung, and the cave is now used for a storeroom. It was never habitable.

A mile north of the above-mentioned cave, toward Dunlap, is a cave with a very large entrance: a sort of rock-house or half dome. The floor is covered with huge rocks and a constant stream flows out. It is said that a party once entered Lakey's Cave and emerged at this one. There is no dry place in it.

PICKETT'S CAVE.—Seven miles southwest of Dunlap is a cave, described as having an ample entrance, with much room inside, perfectly dry, and opening in a cliff 20 or 30 feet above a large, never-failing spring. The description is correct as to location, but not as to size. The opening is about 4 feet across each way, with a slight covering of earth on the floor. The cave winds like a flattened corkscrew. At no place near enough to the mouth for a glimmer of light to penetrate is the roof more than 5 feet above the floor or the side walls more than 5 feet apart.

There are two recesses in the cliff on the opposite side of the little creek formed by the spring. They are 40 to 50 feet above the water, each with an irregular floor of 20 by 30 feet under shelter of the rock. No solid rock is visible in front of them, but a projecting ledge, which seems continuous, appears on either side about 6 feet below the present average level of the floor; and this is probably the depth of accumulation at the front. It may be less toward the rear. The cavities are in a stratum which is somewhat shelly and crumbles easily.

HIXSON'S CAVE.—Six miles northeast of Dunlap is a cave said to be large, accessible, dry, and well suited for occupancy. It is on the side of Walden's ridge, 400 feet or more above the base, a mile from water, and with an opening in the solid rock that can not be entered except on hands and knees. By the time one can straighten up he is in absolute darkness.

LAND COMPANY'S CAVE.—This is 7 miles northeast of Dunlap. To enter, one must crawl between the rock front and the detritus, descending 10 or 12 feet. The floor is fairly level, where it can be found, but is nearly hidden from sight by rocks of all sizes, over and between which it is necessary to scramble almost from the starting point.

HENSON'S CAVE.—This cave, 9 or 10 miles northeast from Dunlap, and perhaps in Bledsoe County, is somewhere on Raccoon Mountains, near the head of a valley up which a mountain road winds along in the bed of a stream. It is said to have a dry dirt floor, with an

entrance through which one must crawl. After driving until the horses were tired out and being assured at several scattered cabins that it was "jest a leetle mite furder up thar," search for it was abandoned

GRUNDY COUNTY

HUBLIN'S OR BAT CAVE.—Numerous caves and rock-shelters are reported in the region about Beersheba Springs. The shelters seem to be shallow with comparatively little earth on the floor. Of the caves, the description given of all but the one named was such as to show them not worth visiting. It is about 10 miles northwest of the springs. Its course is approximately parallel with the mountain ridge, passing under two low foothills or spurs separated by a ravine. When the stream flowing through the latter had cut its channel down to the top of the cave it poured into the hole it had worn. Frost and the natural erosion have made an opening more than 60 feet long. Both parts of the cave remain open, being too large at this point to become choked by the small amount of material which the brook had left as a roof. In some places, so far as it was examined, the ceiling is 50 feet or more above the rocks covering the floor; and one end, that into which the ravine drains, has a continuous and rather steep descent, along the natural dip, as far as it could be followed. Where the exploration ended logs, drift, brush, etc., piled 10 or 12 feet high against huge rocks that had tumbled down, proved a current strong enough to wash away any deposits that may ever have existed; consequently the only earth in this end was that brought by floods.

The other end of the cave is large, with an entrance of such size that small print could easily be read 100 feet from the front if the broad fence across it were removed. This fence was made to close the cave against changes of temperature and also against marauders, it having been used until lately as a storage room for fruit, potatoes, etc.

During the Civil War it was worked for saltpeter. All the earth, down to the rock floor, was removed, even in crevices only wide enough for a man to squeeze through. An incline was built so that horses could be brought into the cave, and no earth now remains within reach of daylight. The rock floor is almost as clean as if swept.

Their exhaustive digging extended for about 200 yards from the entrance. The "face" of the earth is here about 15 feet high; for some reason, which could not be learned, the miners continued their work from here by means of a tunnel 4 or 5 feet high and wide, leaving a floor of earth, and a covering of the same nearly 6 feet thick. This tunnel was not followed.

Near the entrance a crevice barely wide enough for a man to walk in and in some places only 4 feet high turns off toward the left and holds practically the same size for about 100 yards. Here it becomes larger and higher. Earth has been carried out of this and its narrow branches wherever there is room to use a shovel. In a large chamber 200 yards from the front, at the end of the crevice, much digging was done; the "face" left is 13 or 14 feet high.

As far as the diggers went, there is nothing left to explore. Beyond that it is not probable any remains can be found, as it is totally dark long before any remaining earth is reached.

FRANKLIN COUNTY

Several caves were reported in the vicinity of Sewanee and Monteagle. They are objects of curiosity to students and summer residents who frequently visit and make tours through them. They have thus acquired a fame much beyond what is justified by their real interest. They seem to be wet, or with contracted entrances and front chambers, or difficult of access, and, so far as could be judged by the descriptions given, none of them is worth examining.

MARION COUNTY

ACCOUNT'S CAVES.—There are two of these, both with high and large openings, on the right bank of the Tennessee, 2 miles above Shellmound or Nickajack. One is in the face of the bluff, the entrance 50 feet above the river bottom land. Huge rocks lie in front and over nearly all the floor. Surface water flows in at the entrance and after winding its crooked way among the rocks sinks at a point 25 or 30 feet below the top of the débris in front of the entrance. This indicates an open way to the river, so the bottom of the cave is probably down nearly or quite to the water level.

The second cave is 100 yards above the first. A little stream, whose head is in a valley, nearly a mile away, flows around the foot of the bluff and into the mouth of the cave. When the Tennessee rises to flood height the backwater comes into the bed of this stream through the cave before submerging the low ridge between it and the river.

CALDWELL'S CAVE.—This is on the right bank of the Sequatchie River, a mile above its junction with the Tennessee. It is said that formerly a man could walk into it easily for 20 or 30 feet and then crawl 50 or 60 feet farther. This is probably an error of memory. By stooping one can now go in about 10 feet from the edge of the roof, and with a pole feel where the floor and roof come together, nowhere more than 10 or 12 feet beyond. It is said, also, that this

accumulation results from throwing in earth to prevent foxes from having a den in the cave. A small hole might thus be closed, but it is too much to believe that the people now living around here would carry in many hundred cubic yards of earth for any such purpose.

Human bones are reported unearthed near the surface; at least bones of some sort were found which the discoverers supposed were human.

The entrance to the cave is more than 25 feet in width, and about 25 feet above the flood plain of the Sequatchie, or only 15 feet above extreme high water. It is in the only exposure of rock for nearly half a mile along the bluff. On either side of the opening the walls are solid, down to the alluvial earth, but in front of the cavity only detritus can be seen from top to bottom. For this reason it is improbable that any solid bottom could be found above the level of the river. Much of the stone weathers out in small fragments, and the process of disintegration is going on continually, as shown by the fresh appearance of the sheltered fragments. How rapid or how regular it may have been in former time is impossible to guess, so that excavation, to be of any value, would have to begin at the bottom of the slope, with the knowledge that the original floor of the cave may be still lower.

Nickajack Cave.—This is the largest and most widely known cave in Tennessee. It is half a mile from and within plain sight of the railway station of Shellmound, 20 miles west of Chattanooga. The entrance is fully 100 feet wide and 40 feet high; a short distance within the cave enlarges, a little farther it contracts somewhat. Daylight penetrates, in spite of curves and immense piles of débris, for more than 500 feet. It has been a resort from time out of mind; first, for Indians and pioneers, then for refugees, now for various social gatherings.

All the earth in sight has been worked for saltpeter, leached, and thrown aside. A vastly greater quantity than now remains has been washed out of the cave by Nickajack Creek, which always has some flowing water and in wet weather rises 5 or 6 feet. Long bridges are required where the highway and railroad cross it.

It takes its name from the Nickajack Indians, who once dwelt here. The field in front is strewn with flint chips and other indications of aboriginal settlement.

There is nothing in the cave to dig for. The saltpeter miners moved all the earth they could reach, while the immense rocks and the creek make any further excavations impossible.

HAMILTON COUNTY

There are many caves in the vicinity of Chattanooga, but all that were visited possess some feature which makes examination appear

useless. Most of them have small, inconvenient entrances; others are subject to overflow or have running water in them. None could be heard of in which conditions were better.

ALABAMA

LAUDERDALE COUNTY

SMITHSONIA.—There is a noted cave at Smithsonia, near Cheatham's Ferry, 15 miles west of Florence. It was reported as suitable for a dwelling, but at the entrance the roof is not more than 4 feet high, and a stream a foot deep reaches to the wall on either side.

KEY'S CAVE.—On the Buck Key farm, 6 miles west of Florence, is a cave which may have afforded shelter to the earliest man in the region. There are two entrances or antechambers, separated by a solid rock partition a few yards thick. One is partially filled with huge solid blocks, some of them several hundred cubic feet in size; the other has in it and in front of it a mass of earth and loose rock whose crest is fully 20 feet above the highest part of the inside floor a few feet back from the front margin of the roof. From here an additional descent of 10 feet leads to the floor behind the first-mentioned entrance, and there is about the same descent to a nearly level floor in the cave a short distance beyond. The way is partially blocked by large rocks which, it is said, have fallen within a few years. For this reason persons in the neighborhood are afraid to venture in. There is a rumor that the corpse of a woman, coated with stalagmite, can be seen in this cave; also several bodies (sex apparently indeterminate) lying like spokes in a wheel, with heads at the center. No one could be persuaded to go in and point out the place where they lie.

From its position, high in a bluff but easy to reach, not more than one-fourth of a mile from the Tennessee River and the same distance from a clear creek, with a strip of bottom land between it and the streams, this cave seems worthy of exploration. At least a month of work by several laborers would be required to clean away the fallen material so that excavations would be practicable.

COLYER'S CAVE.—This is about 5 miles west of Florence. It faces a ravine that leads into the creek discharging near Key's Cave. Human bones were found in it many years ago. The entrance is a round hole, through which one must creep a few yards, then by means of a pole or ladder descend 6 feet. From here the cave is nearly level, with several branches. In some places the floor is solid rock; in other parts it is covered with a thin layer of earth. The "human bones" consisted of one skeleton, lying on a rock floor, fully a fourth of a mile from the mouth of the cave.

COFFEE CAVE.—This cave, 4 miles west of Florence, is said to be "like the Colyer cave, but smaller in every way." It was not visited.

SHOAL CREEK.—A cave is reported on Shoal Creek "3 or 4 miles above its mouth." No one could be found who knew its location more definitely or was able to give a clear description of it.

BLUEWATER CAVE.—Bluewater Creek comes in several miles above Lock No. 6 of the Mussel Shoals Canal. A cave is reported to be near its mouth, but the only caves anywhere in that vicinity, so far as anyone living or working there knows, are a small hole a mile below on the canal, into which a man can crawl, and one some 3 miles up the creek, reached by climbing down a sink hole in a field. The opening to the latter results from fallen rock.

COLBERT COUNTY

NEWSOM SPRINGS.—Numerous caves, most of them small, are reported in the county. The best known is at Newsom Springs, 8 miles south of Barton, on the Southern Railway. It is locally known as the "three-story cave." The lower "story" is a cave from which water always flows. The second "story" is directly above the first. The two have no connection, unless far back in the hill. The floor of the upper cave is mostly rock. It is now fitted up by some people in the neighborhood as a camping place, where they spend a part of each summer. The third "story" is an excavation for a cellar under a house recently erected.

MURRELL'S CAVE.—Tradition has it that this cave was one of the hiding places of a famous desperado and horse thief whose gang operated over all this country in early days. The only entry is by means of a ladder in a narrow crevice 20 feet deep. The place may have been a refuge, but never a residence. It is one-fourth of a mile from Bear Creek, not far above the mouth.

Two other holes or crevices within a few hundred yards, difficult to crawl through, reach small caves. Possibly all these are connected.

BAT CAVE.—One-fourth of a mile from Murrell's Cave is a small cavern, the roof not more than 4 feet above the floor. It has been inhabited from time immemorial by myriads of bats. Several tons of guano have been taken out for fertilizing purposes, but no evidence has been discovered that it was ever a habitation for humans.

PRIDE'S CAVE.—In the river bluff a mile from Pride Station is a cave in which a fisherman has made his home for several years. There is a rather thin deposit of earth on the floor which may have recently accumulated.

CHEATHAM'S FERRY.—Near the landing some boys, while hunting a few years ago, discovered a stone wall across the mouth of a small cave. Tearing it away, they found within some human bones, flints,

pipes, including one "with a lot of stem holes," and fragments of pottery. All these were on top of the earth or only a few inches below it. Various excavators or relic hunters have failed to find anything more. The cavity is quite small and difficult to reach, and is undoubtedly a burial place for modern Indians.

On both sides of the river here are immense shell heaps. The shell is mingled with earth near the top, but below 2 or 3 feet the mass is of clean shell to a depth, as exposed by the river, of at least 10 feet. The bottom of the deposit is not visible, being concealed by mud piled against it in high water. The old ferryman says it is 20 feet deep. Although the shell piles are built up higher than the bottom lands to the rear or on either side, they are submerged several feet in great freshets. It is impossible to explain this fact otherwise than by the assumption that the bed of the river has been elevated in recent times, although there are no other indications apparent that such is the case.

SHEFFIELDS.—In the river bluff 2 miles above the Sheffield end of the railway bridge is a crevice or joint which has been widened to 10 feet at the outlet by water percolating from the top of the bluff. When discovered, a rock wall was piled across it near the entrance. Behind this human bones were found with "pieces of pottery and other things." They were close to the surface. Subsequent explorations have revealed nothing below them. It is plainly a burial cave for Indians. The river now reaches at flood tide to within 10 feet of the floor. The earth covering the bones may have washed over them, as there is some evidence farther back in the crevice that surface material is still carried in from the rear, in very small amounts, during rainy seasons.

ROCK SHELTERS.—Several very large rock houses exist on the southern slope of the hill or "mountain" lying a mile to 2 miles south of Pride, 7 miles west of Tuscumbia. Water drips from the roofs, keeping the floors wet all the year and collecting in pools to which stock resorts when the little creeks or brooks in the ravines become dry.

It is useless to search in this part of Alabama for caves presenting indications that they may have been habitable, or the reverse, in ages past. The native rock is a cherty or flinty limestone, crumbling easily, and readily susceptible to changes from atmospheric influences, and especially so to the action of water. New subterranean channels are continually developing, with consequent changes in the interior of any cavern near them.

JACKSON COUNTY

ISBOLL CAVES.—It was reported that habitable caves with spacious rooms occur on the Isboll farms, near Limrock. They have en-

trances and front chambers of ample size to move about in, though not more than 15 feet wide. There are broader expansions back some distance beyond daylight. In both caves rocks up to 15 or 20 tons in weight strew the floor, until only narrow passageways exist between them. In addition, water flows from them in rainy seasons, being frequently 2 feet or more in depth.

Blowing Cave.—This takes its name from an outward current of cold air which is so strong as to distinctly modify the temperature of the atmosphere at least 100 yards from the entrance. The opening and the front chamber are nearly 40 feet across, but the distance from the roof to the muddy floor strewn with large rocks is not more than 5 feet at any point. A creek flows across the cave 200 or 300 yards from the mouth, and there is evidence in the way of drift and mud to prove the statement by the owner that after very heavy rains the overflow comes out the front of the cave in such amount as to fill it to the ceiling, and with a velocity that will roll stones larger than a man can lift.

Culver's Cave.—This is somewhere on the side of a mountain about 4 miles from the station of Limrock. Owing to destruction of forests and subsequent growth of brush, the guide was unable to locate it. He described it as a room in which a man could walk about and reached by going in through an opening like a sink hole, which, however, is only about 5 feet deep. The locality, a rugged, barren hillside, near the head of a cove, is not one in which it is probable a cave would be used for any purpose.

Harrison's Cave.—This is 2½ miles west of Limrock. It has a large, high opening, an easy approach, and is quite accessible, being at the foot of a mountain with level bottom land in front. A stream flows directly across it some 30 feet from the entrance, emerging at the foot of one wall and disappearing under the other. The earth bank on each side of the stream is about 5 feet high, indicating at least that depth of deposit on the rock floor; as the latter is not visible the amount may be much greater. This earth is soft and wet. In rainy weather water from the interior flows along the floor into the little stream. Sometimes this can not dispose of the surplus, and the overflow rises until it makes its exit through the mouth of the cave. When this happens all the earth within is covered from 2 to 5 feet deep.

Saltpeter Cave.—This lies 4 miles south of the railway, between Limrock and Larkinsville. It is described as being dry, with a large, high entrance, and "plenty of room inside right at the front." But it was thoroughly worked during the war by saltpeter miners who took out all the dirt they could easily reach, going back "200 or 300 yards." For this reason it was not visited.

DEKALB COUNTY

FORT PAYNE CAVE.—A mile south of Fort Payne is a cave in Lookout Mountain, which a "boom" company some years ago converted into a summer resort. The detritus in front of the entrance was leveled off, steps constructed to the top, and a heavy stone wall built across the mouth, leaving an entrance a little less than 7 feet in width which was closed by gates. Inside the barrier the floor, now made tolerably level, extends about 30 feet toward the rear, to the natural rock wall, and is 50 feet from side to side, with a roof from 6 to 15 feet high. In the wall at the rear are two small openings through which explorers can pass to large chambers farther within. To the right of the front chamber is a branch cave which is high and wide at the beginning but soon becomes impassable from the accumulated rocks and earth rising to the roof. The left side of the front chamber is continued in another branch going directly back into the mountain. The roof and floor have an equal slope downward to a point some rods from the beginning, the clear space between them being not more than 4 feet. Beyond here the roof is high and there are some large expansions. A creek flows from the rear of the cave to a point estimated as 200 yards from the doorway, where it sinks into the earth. The noise of its fall is distinct throughout the front part of the cavern. There is considerable drip, and though dry stalactites and stalagmites occur in some places, over most of the front chamber their formation is still in progress. Outside of the doorway the solid rock walls show on each side, nowhere less than 25 feet apart. At a depth of 30 feet water flows from the rock and earth between these side walls, but there is no sign of solid bottom, so the depth of the cave is probably more than 30 feet below the present floor.

Under existing conditions the cave would form an excellent shelter, being accessible, roomy, and with an abundant supply of fresh water. The drip from the ceiling could be avoided. But it does not follow that such was the case in the remote past. It is apparent that at one time the creek had its outlet through the mouth and down the gorge in front, the right branch of the cave being then open. From some cause, probably the formation of a sink hole above, water from the surface or near the surface found a way through this branch, carrying mud and rocks sufficient to fill the front chamber to its present floor, diverting the flow of the stream, and finally filling the cave through which it came. While the creek was flowing, occupation would be impossible, or at least inconvenient. When the mud began to settle in, the front portion would be shut off. This condition would hold until the stream found its new outlet and the branch cave had become entirely filled; and when these processes were completed the

floor of the cave would be practically at its present level. Under the circumstances exploration would probably, almost certainly, be fruitless. The company which owns the cave would also wish it restored to something like its present state.

ELLIS CAVE.—On the estate of Dr. Ellis, 19 miles north of Fort Payne and 3 miles from Sulphur Springs, are two caves known locally as Big-mouth and Little-mouth. The smaller is closed by a locked gate. The larger has a rather imposing appearance from the outside. From a ledge of rock, in place, in front of it, one looks down a steep slope in which rocks up to 40 or 50 tons weight are imbedded. At a vertical depth of 30 feet is a level space not more than 8 or 10 square yards in area. From this a narrow crevice goes to the right. Within a few yards it reaches a hole which can be descended only by means of a rope or ladder. Persons have, however, gone several hundred yards in it.

On the left of the level space and bounded on each side by solid rock walls is a pit 10 feet deep, caused by inflowing storm waters which have created this depression in seeking a small outlet, also toward the left. The height from the bottom of this sink to the roof of the cave is nearly 50 feet.

Crossing this pit on a foot log, which rests on loose rock and earth at its farther end, a crevice varying from 6 to 10 feet wide goes inward for 50 feet. Earth covers the loose rock at the level of the foot log almost at once, and this earth has a steep ascent toward the rear. The crevice widens beyond the distance mentioned, though irregularly, being in some places 25 feet from side to side. So far as progress is concerned, the cave terminates 150 feet from the doorway in a blank wall. It may be that if the earth were out of the way further progress would be possible.

Considerable digging has been done for saltpeter, but except near the front it has been only superficial.

The top of the earth at the extreme rear of the cave is almost or quite as high as the roof at the front, which means that, if the bottom should be level, the thickness of this accumulated deposit is not less than 35 feet. As the dip is toward the rear and quite sharp, about 10 or 12 degrees, the earth here may well be much thicker than indicated.

Excavation would be tedious and costly, as it would be impossible to dispose of the dirt except by blasting a deep trench through the rock in front to make room for wheeling it out.

KILLIAN CAVES.—There are two of these, both on the west slope of Lookout Mountain. One is near Brandon, 6 miles south of Fort Payne. The entrance is a large sink hole on the side of the mountain, descent into which is difficult owing to the steepness and large rocks. At the bottom the water which flows in over the muddy floor

from the slope above—several acres in extent—rushes into a hole choked with loose stones and disappears.

The second cave is about 3 miles northeast of Collinsville. Débris from the mountain has formed a wall across the entrance, which is naturally wide and high and opening out on a little flat in front. Some digging has been done for saltpeter at the front part of the cave, reaching about 30 feet back from the inner foot of the accumulation. In the pit thus formed water stands after every rain until it soaks away. Where it ends the "face" is about 5 feet high. On top, farther in, there is much travertine or stalagmite; in some places it extends entirely across the floor. In other places the floor is bare. There is constant drip, and in one room there is a little gully, where surface water in wet weather, entering from a small branch cave on one side, has cut an exit through the earth at the foot of the wall on the other side. The hole in which it disappears extends beyond the rays of a lamp, and a stone thrown in goes down a slope several feet in length. Very little working is needed to reduce any of the earth to soft, slippery mud, hence no excavation was possible.

MARSHALL COUNTY

FEARIN CAVE.—This is in a bluff on the right bank of the Tennessee River, 10 miles below Guntersville. It has three divisions. Shortly after passing the spacious entrance a branch turns to the right. In a few feet a wall is reached which can be scaled only with a ladder. Climbing this, a large chamber is reached, totally dark, and the home of innumerable bats whose "guano" covers the floor and fills the air with a stifling odor. This branch comes to light again more than a mile away on the side of the mountain.

Returning to the lower chamber and going back about 100 feet from the main entrance, a wall similar to the first is reached, above which is another large cave. Bats never inhabit this, and the floor is of loose dry earth. But no ray of daylight penetrates it, and as a great amount of saltpeter was made here during the War of 1812 scarcely any of the earth retains its original position. During the Civil War the floor of the lower or main cave was also dug up for making saltpeter and much of the leached earth piled in front of the cave. This acts as a dam against encroachment of the river except in the highest floods. There seems, however, to be a passage between the cavern and a spring under the river bank, for water appears on the floor as soon as it reaches the same height outside and the two surfaces maintain a constant level until the freshet subsides. On account of these facts no excavations were made.

HARDIN'S CAVE.—Nine miles below Guntersville, on the right bank of the Tennessee, is a ferry known as Honey Landing. It is at

the lower end of a steep bluff which forms the river front of a high hill or mountain, as such elevations are called here. A few feet above high-water mark a narrow ledge or shelf projects, which can be reached only from a point on the side of the hill just above the ferry. About 100 yards from here the ledge reaches a cave, which has a high and wide entrance, with ample space for several families to live on a fairly level, well lighted floor. If the cave were dry, it would be an ideal primitive home. But water continually seeps down the hill above and falls over the roof at the entrance, while a gully through the cave and several minor washes, as well as the mud spread over the floor, show that a large amount of water flows through the cave in wet seasons and covers all the floor except an area some 15 feet in diameter. This is dry on top, but would be muddy at a depth of 3 or 4 feet, the level of the bottom of the gully, so no exploration was attempted.

Welburn's Cave.—Six miles northeast of Guntersville is a cave in which many human bones have been found. It is only a burial place and could never have been used as a dwelling. The entrance, barely large enough to crawl into, is at one side of the bottom of a large sink hole due to the falling in of a cave roof. It receives all the rainfall of more than an acre and is nearly choked with mud and driftwood. It may have been somewhat larger at one time, as there is a tradition that a deer was chased through the cave, coming out at Bailey's Cave, a mile away. Within a few rods the water sinks into the earth, and the floor of the cave, rising beyond this point, is dry. It was on this dry earth, not in it, that the skeletons were found. The floor is uneven, at some places permitting a man to stand, and at others rising to within 3 feet of the roof. Explorations can not be made, as there is no method of disposing of the removed earth.

Bailey's Cave.—This cave is 7 miles northeast of Guntersville. The entrance is high and wide and there is a large, well-lighted area within; but the cave is flooded every time Town Creek gets out of its banks. Bailey's Cave is the other end of Welburn's Cave, as persons have gone through the hill from one to the other.

Barnard Cave.—This cave, which is also called Alford's and is still more commonly known as Saltpeter Cave, is on the left bank of the Tennessee 10 miles below Guntersville and opposite the Fearin property. The entrance is at the foot of a bluff overlooking a strip of bottom land a fourth of a mile wide, but the opening is above any flood that has occurred since the country was settled. At the foot of the slope is a bayou filled with Tupelo gums. Between this and the river the ground can be cultivated.

The cave is so straight and the walls so smooth as to look like an artificial tunnel. The entrance is in plain view from a point 380

feet back, and the change of direction, even at that distance, is very slight. The saltpeter miners started at the entrance and removed all the earth lying from 3 to 6 feet higher than the present floor, which is nearly level. They carried their work along the surface of a stratum of gravel, sand, and clay, which is so compact as to be difficult to remove with a pick, and seems to belong to the stream which carved out the cavern. The "face" where they quit work is 5 feet high, and the earth is quite dry, breaking down in angular fragments and separating from the walls so freely as to leave no residue on them. Its original depth at any point, however, may be very easily ascertained by noting the different tints or shading of the wall rock, the lower part, which was protected by earth, being distinctly lighter in color than that above, which was exposed to atmospheric weathering and, for a time, to the smoky torches and candles of the workmen.

The distinct lamination of the saltpeter earth, as shown in the "face," proves it to have been laid down slowly and intermittently in still water. It could not be determined whether this was due to the river in flood periods, or to a gentle stream from the interior whose volume varied in accordance with weather conditions. There is also a small channel along the top of the earth, filled with gravel and sand, as if the overflow of a stream far back in the mountain had been diverted in this direction after the laminated deposits had become dry and settled.

The walls are 10 feet apart near the entrance, but are not more than 8 feet elsewhere and in some places the width narrows to less than 3 feet. They also have an inward slope at the bottom, so the cave is either shallow or else so narrow at no great depth as to be uninhabitable. This fact, and the character of the material deposited by the ancient drainage stream, make it hopeless to expect result from exploration.

McDERMENT'S CAVES.—There are two caves 100 yards apart, in Brown's Valley, 11 miles southwest from Guntersville. The larger has a descent of 21 feet from the front to the general level of the first floor. All this part is well lighted. The drainage from several acres of the mountain side above pours over the roof at the entrance and runs down the inner slope. It has worn a gully, and the first level it reaches is quite muddy. Leaves and trash 3 or 4 inches deep are piled on and against the loose stones toward the side where the water seeks an outlet. It has worn a crooked channel along this side of the chamber, and falls into a hole which at a depth of 10 or 11 feet below the floor makes a turn and passes from sight. So it is certain that soft wet clay extends more than 30 feet below the level of the entrance. The drier deposits of this room have been extensively worked for saltpeter, and a much greater quantity of earth

would have been removed but for the fact that masses of stalagmite, too thick to break off with a sledge hammer, and scores of columns, some of them 6 or 8 feet in diameter and many tons in weight, cover a considerable part of it. The first room is succeeded by several others, all of which are dry and of large size, but in total darkness, and the floors in all have been more or less disturbed in the search for niter. The general direction of the bottom is downward. The last floor is probably 50 or 60 feet lower than the entrance, and is reached by a slope on which it is difficult to retain a footing. In nearly every part the earth is covered by stalagmite, much of it so heavy that the miners could not remove it, but were compelled to dig under it as far as they could reach; and in no place is a rock floor to be seen.

The thickness of stalagmite on the floor, and the great size of the columns, is proof of their antiquity, while the depth of earth beneath must have been thousands of years in accumulating before the deposits began to cover them.

Excavations here, while quite desirable, would be very expensive. Much stalagmite would have to be blasted; upward of a thousand yards of earth moved, and all of it taken out of the cave, because there is no room for it inside. As a man can not push a wheelbarrow up such an incline, a trench must be cut through to the exterior slope; and as solid rock lies not more than 5 feet below the surface at any point, blasting would be necessary the rest of the way. The task is equal to opening a stone quarry.

The second cave on McDerment's place has a good opening. A trench 4 feet wide and 6 feet deep where the rock is thickest has been blasted out to make a level approach to the entrance. Masses of stalagmite on each side, sloping like solid rock from the walls, leave barely room for a man to walk for the first 30 feet. Here the walls recede somewhat, and a pit nearly 15 feet deep yawns before the explorer. After continuing for some distance with this depth, there is another drop of 10 feet which holds until the end of the cave is reached. This entire depression is due to the removal of earth for making saltpeter. It is evident that a vast amount of material has been carried out.

As in the first cave, excavation would be very difficult and expensive. All rock and earth would have to be carried up a steep grade, or a deep cut made to wheel it out. As the light is very dim at the first widening of the walls, it is not probable the space farther back would be occupied unless as a refuge.

Both caves were eroded by water running *into* the hill, and the end of each is abrupt, the roof being higher and the walls farther apart than at any point nearer the entrance. The original outlets are now filled with earth, and apparently have been so for ages.

FORT DEPOSIT CAVE.—Six miles below Guntersville the highway to Huntsville crosses the Tennessee River at Fort Deposit Ferry and passes out through a narrow valley between two bluffs. Less than 100 yards above the landing, on the north, or right, bank, is a large cave from which the spot takes its name; there being a tradition that it was used by General Jackson as a storage room for supplies during the Creek Indian war. On either side the bluff is vertical to the water's edge, making the cave now inaccessible except by boat. In front of the entrance the rock is worn in ledges which can be easily ascended.

The opening or mouth of the cave is oval in form, about 18 feet high and 15 feet wide. The sides are uneven, there being a projecting shelf on each side near the floor. At 40 feet from the opening these disappear, owing to the narrowing of the cavern. There is a gradual ascent of the floor toward the rear, the rise being about 2 feet in the first 60 and more rapid from that point onward. A thin deposit of dried mud on each side, where it escapes the feet of visitors, shows that the river enters the cave at times, but not to a depth that carries it back more than 25 feet. The present ferryman says the flood of 1867 is the only one which has reached so far within that period.

After clearing away the earth, roots, and rocks at the front, a straight vertical face at a distance of 18 feet from the entrance measured 9½ feet at top and 5 feet at the bottom between the solid rock wall on each side, and was 4 feet 4 inches high. The floor was not of solid rock entirely across, there being a crevice less than 4 feet wide which was not cleaned out, because no one could have lived in it. About the middle of this bank (vertically) streaks of red earth, burned elsewhere, extended 3½ feet out from the right wall; there was very little ashes and no charcoal mixed with it. Above this red the earth was dark like garden soil and contained a few shells and fragments of pottery, with a little charcoal and ashes; it had all been disturbed and apparently resulted from scraping the débris away from camp fires. Below this, the line of demarcation being very distinct, the earth was yellow and sandy, like river bottom land, and contained no foreign matter except roots of trees growing outside. Figure 23 shows a section on this line; the crevice is omitted from this and the subsequent illustrations.

At 20 feet in, a foot below the top of the dark earth, was some charred corn. The yellow earth became irregular, thinner, and higher against the side walls than at the center. (See fig. 24.)

At 22 feet the yellow earth had nearly run out, there being only a small amount against either wall, while the darker earth reached down into the crevice that opened in the narrow strip of rock floor.

In the lower portion were mingled a few shells, pebbles, and specks of charcoal, as if it had been thrown there. Across the upper portion of the deposit extended fire beds, burned earth, ashes, shells, broken pottery, and occasionally a fragment of bone. (See fig. 25.)

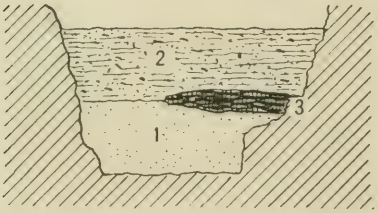


FIG. 23.—Cross section of Fort Deposit Cave at 18 feet.

At 24 feet it was found that what had been taken for a solid floor in the last section represented was only a large flat rock which had fallen into the crevice and wedged tightly. When this was passed the yellow earth reappeared, at a slightly lower level.

At 26 feet the yellow earth became mixed with red. It was excavated to a depth of 5 feet in the endeavor to discover the reason for this. As there was not the slightest trace of ashes or charcoal, the red admixture must be a natural result of staining by iron in some form and not due to heat. Above the yellow was the usual stratum of dark earth, containing culinary débris. In the central portion of this was a mass, sufficient to fill a wheelbarrow, of angular, unburnt fragments of limestone from 3 to 15 pounds in weight. On the surface of the dark earth were some ten or twelve fire beds, reaching from wall to wall, the edges overlapping and interlacing in so confusing a manner that the exact number could not be made out. (See fig. 26.) At this stage it appeared that the crevice, or at least its upper part, had been filled by river floods and a slight ridge of sand thrown across the mouth of the cave. The Indians, it seems, occupied both this ridge and the lower area behind it, throwing débris to the rear to fill up the depression instead of carrying it all to the outside. It is equally possible, however, that this waste was brought from points farther back and thrown here to fill and level the floor. These heavy fire beds came to an end at about 28 feet on the right and 29 feet on the left. A section at 28 feet is given in figure 27. At their inner margin, among the ordinary refuse characteristic of such deposits,

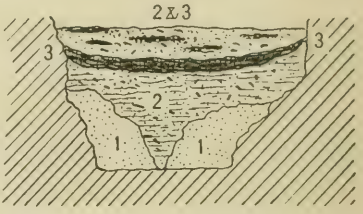


FIG. 24.—Cross section of Fort Deposit Cave at 20 feet.

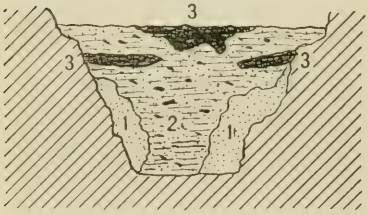


FIG. 25.—Cross section of Fort Deposit Cave at 22 feet.

were many fragments of human bones, including ulnas of two individuals, one much larger than the other. They plainly indicated cannibalism, as they were broken when thrown here. Besides the ulnas, there are pieces of ribs, scapula, tibia, and feet.

At 29 feet the underlying yellow earth became comparatively level across its upper surface, again closely resembling a river deposit. The darker earth above it contained a greater amount than heretofore of ashes, bones in small pieces, potsherds, mussel, snail, and periwinkle shells, and the like. More charred corn was found along here.

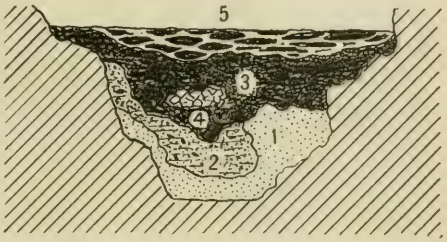


FIG. 26.—Cross section of Fort Deposit Cave at 26 feet.

At 30 feet the yellow earth began to rise, and at 32 feet it was very little more than 3 feet lower than the top of the highest ashes. A section at this point is shown in figure 28. At 35 feet the strata became quite regular and uniform from wall to wall. The dark earth, next above the yellow, measured 3 feet in thickness at the center, and while showing by its admixture of ashes, etc., that it had been thrown here, had evidently formed the floor for a considerable time. The upper foot was burned red or dark from long-continued fires, the ashes above it being from 6 to 8 inches thick, and forming the present floor of the cave at this place. The dark earth contained much less of refuse than nearer the entrance; such shells and ashes as appeared were promiscuously distributed and not in little piles or masses as before. A section at 35½ feet appears in figure 29. It may be remarked here that this is the only sketch in which the upper line coincides with the surface of the deposits. In the others a thin covering, less than 6 inches at any point, of disintegrated material from walls and roof covers the ashes left by aboriginal fires. This is omitted from the drawings.

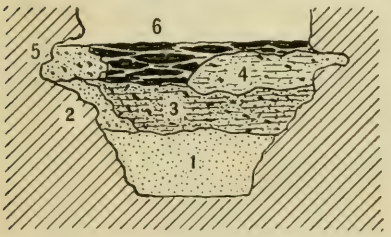


FIG. 27.—Cross section of Fort Deposit Cave at 28 feet.

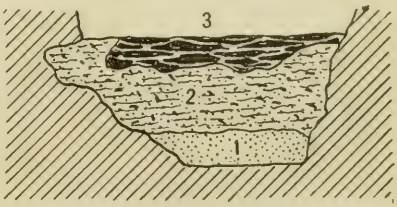


FIG. 28.—Cross section of Fort Deposit Cave at 30 feet.

At 38 feet the yellow earth had risen until it was within 3 feet of the top of the entire overlying deposit. The latter contained little of the dark earth, being mostly composed of ashes and burned earth, some of which resulted from fires made on the spot, but the greater part being thrown from other points. The rise of the yellow earth, consequently, is more rapid than the rise of the material covering it.

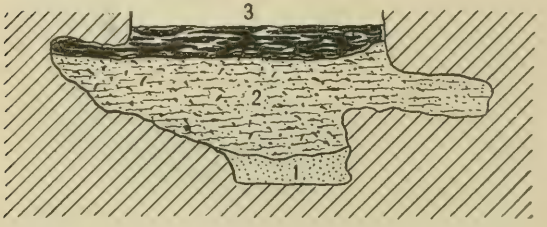


FIG. 29.—Cross section of Fort Deposit Cave at 35½ feet.

At 40 feet there was a dip in the yellow earth, extending for 4 or 5 feet and descending 2 feet at the deepest point. This may be due to drainage at a lower level.

At 47½ feet a pocket of the dark earth extended a few inches into the underlying yellow earth. A hole seems to have been dug into the latter. There was no more of foreign material in this hole than elsewhere in the dark earth above and around it. It is shown in figure 30.

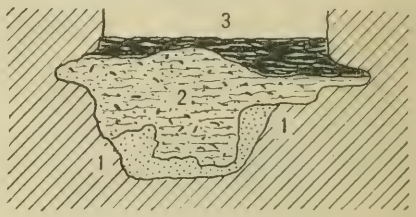


FIG. 30.—Cross section of Fort Deposit Cave at 47½ feet.

The amount of shells, pottery, etc., had been decreasing for several feet before this point was reached; indeed, from 40 feet onward there was very little of it—enough, however, to show that all the dark earth had been disturbed and thoroughly mixed. The fire beds, too, while holding their depth of about a foot, contained more earth between the successive layers of ashes, showing as great age, probably, as those nearer the entrance, but less continuous occupation. This condition prevailed to about 60 feet from the entrance, at which point the yellow earth, now mixed with sand and gravel, was only 3 feet below the surface of the floor. The appearance of this line is sketched in figure 31.

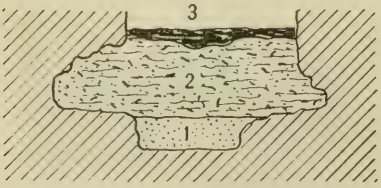


FIG. 31.—Cross section of Fort Deposit Cave at 60 feet.

At 62 feet there was a dip in the yellow earth, extending to 67 feet and 2 feet deep at its lowest point; it then rose to the usual level.

At 70 feet ashes appeared in greater quantities; at 73 feet the dark earth was only a foot thick, the ashes and burned earth being 2 feet

thick and apparently all dumped, as there was no definite arrangement of the various parts. (See fig. 32.) A small perforated disk and a double-pointed bone needle were found here.

The fire beds now began to thin out rapidly, the dark earth also diminishing in quantity, until at 80 feet, from which point the entrance was no longer visible owing to curvature of the walls, there was only 5 or 6 inches of them in all, resting directly on the yellow earth, which contained much more clay than farther toward the front. The walls began to diverge here, forming a room whose greatest width was 11 feet 6 inches at 95 feet. At 100 feet a reverse curve brought the cavern on a course parallel to that which it had held up to 60 feet.

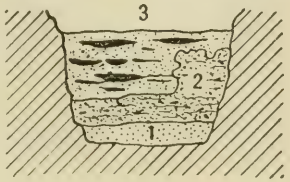


FIG. 32.—Cross section of Fort Deposit Cave at 70 feet.

At 90 feet there was evidence of fire at one side, the ashes and burned earth being 5 inches thick at the wall, and thinning out to a feather edge within 4 feet. This was the last fireplace discovered which may not with certainty be attributed to white men. The yellow earth, presenting no evidence of having been disturbed since originally deposited, reached from the superficial layer of loose dry earth to the bottom of the trench, a depth of 4 feet 8 inches. Below this point the walls were less than 4 feet apart, and the space filled with gravel, as shown in figure 33. This gravel had exactly the appearance of that in gullies on the hills outside, and plainly dates back to the period at which the cave was formed. The stream which aided in the erosion, or which flowed through from some sink hole or other outside opening, carried this gravel into the crevice. Consequently, even if the space between the walls had been ample for dwelling purposes, an attempt to live here when the gravel was being carried in would result in the intending settler having his effects washed out into the river.

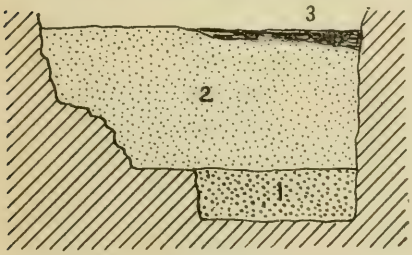


FIG. 33.—Cross section of Fort Deposit Cave at 90 feet.

At 93 feet the side walls confining the yellow clay narrowed to a little less than 5 feet apart. The upper portion of the one to the left has been eroded into a recess or cavity, forming the chamber above mentioned. The earth on the rock floor in this recess

is nowhere more than a foot deep. A section is presented in figure 34.

At 100 feet the room came to an end. The space between the walls was 7½ feet at the floor level and 4 feet at a depth of 4 feet. At 105 feet the nearly vertical walls were only 5 feet apart on the floor; at 112 feet the space increased to 7 feet. A section showed about a foot of loose earth mixed with ashes; 3 feet of yellow clayey earth, rather compact; then gravel and sand. The latter was dug into for a foot, at which level the walls were converging and it was useless to go any deeper. Enough was done, however, to verify the supposition that this stratum was due to the action of running water seeking its outlet at the mouth of the cave.

At 103 feet, at the bottom of the yellow clay and on top of the gravel, was a chalcedony pebble about 2½ inches in diameter. The material is foreign to this locality. It had plainly been used as a hammer stone, and is the only object of human origin found anywhere below the dark earth. There was not the slightest evidence of any disturbance of the clay in which it rested.

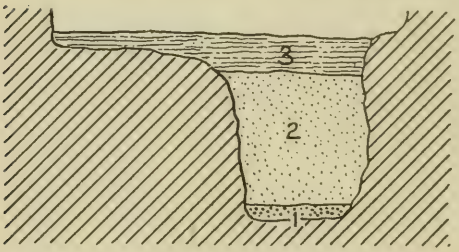


FIG. 34.—Cross section of Fort Deposit Cave at 93 feet.

At 120 feet the side walls were only 5 feet apart. At 125 feet they again diverged slightly, and a recess on the left forms a chamber 12 feet across. At 150 feet they had drawn in to 8 feet at the widest interval. A section showed loose dry earth, some of it cemented by drip from the roof until about as hard as lump chalk; then compact clayey earth, also with travertine in small lumps; below this the gravel and sand. The latter, at this point, seems to have been deposited in the last stages of the formation of the cave. Occasionally, along here, a small patch appeared that seemed to be ashes; but none of it was more than 6 inches below the top of the ground, and the substance may not have been ashes at all, but the fine white limestone dust that wears off from the stone. There was nothing in the trench, at any depth, after the chalcedony pebble, that could possibly be due to human intervention, except these small patches of ashes, if ashes they are.

At 165 feet from the entrance the cave made its fourth turn and expanded into a chamber about 15 feet wide. Along the sides of this and in the various crevices opening from it were great quantities of clean ashes, plainly enough thrown there from fires made in the central part. The gravel came to within 3 to 5 feet of the top,

being quite irregular. On the gravel was dry clay, seamed and fissured in all directions so that it fell out under the pick in clods like angular pebbles from an inch to 3 or 4 inches across. This was clearly the result of muddy water settling in a hole and thoroughly evaporating. There was also some travertine in small lumps here and there through the clay, and above it was a mass fully 2 feet thick at one side of the trench but running out before it reached the other side. It was porous, almost spongy, and seemed to be the lime dust from the roof and sides cemented by dripping water. Above all this, so far as the trench extended toward the sides of the cave, was an inch to 4 inches of loose, dry, dark earth, which on the left dipped down to the clay, thus replacing the travertine.

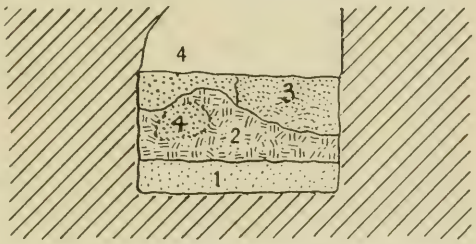


FIG. 35.—Cross section of Fort Deposit Cave at 175 feet.

At 175 feet the gravel had leveled down and was more or less mixed with clay and sand. Above this was another "mudhole deposit" of clay which had thoroughly dried out and become checked and cracked in all directions. On the right this was covered with travertine slightly mixed with earth and clay; on the left, above it and also at one place within it, was a coarse gritty earth fallen from the roof but not converted into a compact travertine. The section appears in figure 35. At 180 feet the trench was carried to a depth of 6 feet. This exposed a fine clay and sand, or silt, like that deposited in the eddies of streams. Above this was another deposit of "mudhole" material which had thoroughly dried out, checked and cracked in all directions so that it formed angular masses of various sizes, and had then become wet again so that it was now soft and sticky. To the left of this, on the silt also, was a small amount of the gravel. It had the appearance common to a bank of such material on the side of a little stream which has undermined and carried away part of it. Clearly, these three formations were of an age that witnessed the erosion of the cave. Next above them was a stratum of loose dark earth similar to that noticed in the front part of the cavern; but here were found no traces whatever of man's presence. Into the right side of this stratum projected the wedge-like edge of a mass of

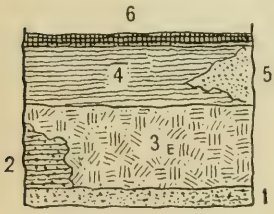


FIG. 36.—Cross section of Fort Deposit Cave at 180 feet.

travertine, which was not traced to a termination. Over all lay a deposit 3 or 4 inches thick of dark, nearly black earth, mixed with ashes. This is quite modern. The section appears in figure 36.

During the Civil War the cave was continuously resorted to by deserters, refugees, moonshiners, fugitives, and "food for powder, dodging the conscript." All these sought shelter in this chamber and behind it, in order that their fires might not be visible from the river. The piles of ashes in the crevices and corners were thrown there by these hiders-out, to get them out of the way. Similar but smaller piles of ashes are to be seen all along as far as the spring, 200 yards from the entrance.

The presence of pottery of a type common to this region in fields and shell heaps, and of maize, denotes that all the fire beds, etc., are the results of habitation by the modern Indian. Where these ceased nothing else was found. In or below the yellow earth, clay, or gravel, nothing can be found; for until these were laid down and the stream of the cave had sought another outlet, there was no dry place in which to live.

It may be worth recording that a dead mulberry tree stood about 20 feet in front of the entrance to the cave. Under it was a narrow crevice filled with earth, but all around it was bare rock. A root, larger than the tree, grew into the cave and followed along one side wall as if fastened there for a distance of some 60 feet. Here the earth floor of the cave came high enough to cover it. This root was exposed for 160 feet in the trench, or 180 feet from the tree; at this point it was 3 inches in diameter and turned aside into a crevice. As the root could not have grown in the open air, it furnished proof that much deposited material has been carried out of the front portion of the cavern and away from the ledge since this tree was a sprout.

III. EXPLORATIONS ALONG THE MISSOURI RIVER BLUFFS IN KANSAS AND NEBRASKA

VICINITY OF WHITE CLOUD, KANSAS

About 4 miles southeast of White Cloud, Kansas, is the "Taylor Mound," from which Mark E. Zimmerman and William Park took 56 skeletons, or portions of skeletons, in a space not more than 6 by 20 feet. This was clearly an intrusive communal burial of skeletons carried from some other point and interred in the mound which owed its origin to persons who had piled it up at some previous time. The bones, which were not arranged in any order, were 30 inches beneath the present surface of the mound, but this does not mean they were no deeper originally, as the mound has been plowed for many years and is in a situation where it will easily wear down when cultivated.

A few feet away, at a depth of 7 feet, other bones, or fragments of bones, were found in a mass of burned clay. A cremation had taken place at some point away from the mound, and the resultant burned earth, with so much of the bone matter as was not destroyed by the fire, was carried here and buried. The depth in this instance is not significant; the earth is loose and very easily dug; besides, the grave pit was near the margin of the mound and earth had washed down over it from above.

Some stones, carried from neighboring ravines, have been exposed by the wear due to erosion from natural causes and from cultivation. The main portion of the structure is still intact, and it is probable that no deposits belonging to it at the time of its construction have been unearthed. A systematic exploration, showing the original construction as well as the alterations resulting from later burials, is much to be desired.

While this is the largest mound in the vicinity, and is claimed to be the largest mound in Kansas, it is not different except in size from many others within a few miles. All of them are made of the same earth as that which lies around them—a light, sandy loess which is easily removed with a shovel, requiring no picking or other loosening. In fact, it is almost as easy to dig as loose sand would be. Sometimes there are flat limestones in or around the graves; similar slabs are found not far away in the ravines.

Not far from this mound is a large lodge site, one of the so-called "buffalo wallows" as they are commonly known. These are the ruins of aboriginal houses. The general construction is the same, the only practical difference being that some are square in outline, others round. This difference is not always apparent prior to the excavation. In the making, a pit was dug, square or round as desired, and the earth thrown out on every side. Posts were then set around the margin of the excavation, and the house built in the same manner as those with which we are familiar from accounts of early travelers. Many of them have been examined by Zimmerman and Park, who found masses of hard-burned earth in which are cavities and depressions due to the burning of straw, grass, twigs, and poles, used in the construction of the houses. This results from the destruction of the houses by fire. Sometimes the floor has a layer of this burned material which is evidently due to the falling in of the roof. Most of these are on the hilltops, but some of them are on narrow ridges leading from the high land to the creek or river bottoms. In the latter event there is always a village site on the low ground bordering the stream. The relics gathered up on these village sites are in no wise different from those found when the lodge sites are excavated; and also are of the same character as those picked up on what are no doubt modern village sites in the vicinity. This fact militates against the idea that the lodge sites are extremely ancient.

IOWA POINT

On a low hill, cut off on every side by steep ravines, is a small mound containing a cist grave. The bottom of this, which was dug slightly below the natural surface, was covered with a pavement of limestone slabs. The grave was roughly oval or triangular in outline, measuring about 7 by 9 feet. Around it was a wall of similar stones, set in contact and sloping outward at an angle of about 40 degrees from the vertical. There was nothing whatever in this grave.

At the edge of the mound was a box grave 5½ by 2½ by 2½ feet, the longer axis on a radial line. It was made of small flat stones built up like a wall, the only grave of which I could learn that had any resemblance to the vault graves farther down the Missouri. In the grave were two skulls and some other bones, all bunched in the northern end.

NEAR THE MOUTH OF THE NEMAHA RIVER

Lewis and Clark, in their journal, mention that when camped near the mouth of the Nemaha, one or both of them went to an Indian village about 2 miles up the stream. He, or they, climbed a low ridge near the river and stood on a mound which commanded a fine

view of the surrounding country. There is a dispute as to the site of this mound; but the journal plainly says it was on the lower (east) side of a little creek which comes in here. Two miles farther up is a larger mound on higher ground which is generally supposed to be the one meant by the explorer; but this is on the other side of the creek and at some distance from the Pawnee village which was located near the mouth of the creek, on the lower side. The ground where this village stood is covered over a space of several acres with the ordinary débris of an Indian settlement; and it is significant that all the relics found are so similar to those which are called "ancient" when found in the lodge sites, that no one could determine from inspection which kind came from which place. Unless it may exist in the markings in the pottery, no distinction can be made between these specimens and similar ones from other localities.

The Pawnees lived here until 1837, when the Iowas and Otoes made a sortie upon the unsuspecting inhabitants and killed all of them they could overcome. Two women of the Iowa tribe who were living on the reservation in 1914 remember seeing dead bodies lying around wherever the invaders could find and kill a resident.

A short distance below the explorers carved their names on a rock which projected into the stream. Accounts as to this spot differ; it is generally stated that in making a road around here, the rock containing the names was blasted away; but a man in the neighborhood who claims to know the exact spot says the blasting did not extend quite so far and that the names are covered by a mass of earth and rock which slid from the bluff many years ago. If this be true, a thrill awaits the man who finds the names some centuries from now, when the river has washed away all this accumulated material.

VICINITY OF TROY, KANSAS

Near the mouth of Wolf River is a village site on which Dr. R. S. Dinsmore, of Troy, has counted 125 tipi sites. Relics are very abundant here, especially the small chert "thumb-scrapers," which outnumber all other specimens.

MOUTH OF MOSQUITO CREEK

Four miles east of Troy, on a ridge so steep that its top is inaccessible from either side, and so narrow that a wagon would make a track on each slope, is a little mound worn down until its true nature would not be suspected. Dr. Dinsmore was on this ridge one day and noticed a flat limestone rock. Knowing that it had no place in the loess, he began digging to ascertain the reason for it being there. At a depth of a few inches he found bones, and soon unearthed a number of skulls, with only his hands or a stick. Coming back later with tools, he found, in all, 56 skulls. Afterwards he found

others, and persons in the neighborhood have exhumed many more. The deposit represents a communal burial, from a village which probably stood on the level creek bottom not far away. A few skeletons showed an attempt at orderly arrangement. These were probably of individuals who had not been dead long at the time of the general burial. Most of the bones, however, skulls and others, were piled in the smallest possible area, as if gathered up in sacks or baskets from previous burials and carried here for reinterment. The soil is so loose as to be easily dug with the hands, like sand; but at the same time so fine and close packed as to shed water almost like a roof. Owing to the steep slope at every point, except toward the summit of the ridge, there must be some erosion, and consequently the age of the burials can not be great. Yet, the same conditions prevail in other places where a great antiquity is claimed for the remains. Frost necessarily disintegrates the soil to some extent; the wind or rain carries away the loosened portions; and this process is continuous. The shape of the mound shows that when the burials were made the ridge was essentially identical in form with its present aspect. The bones also are comparatively fresh in appearance, and it may be considered certain that they can not date back many generations.

On the top of a hill rising from the opposite side of Mosquito Creek Dr. Dinsmore found a low mound, which, like that just described, would not have been suspected as such but for a stone projecting from the surface. Under this stone, with 8 inches of earth intervening, was a skull so completely mineralized that it appears to be carved from a block of limestone. No other portions of the body to which it belonged remained, though traces in the surrounding earth showed that at least the larger bones and perhaps the entire skeleton had been deposited. Bones in other parts of the mound were in their natural condition; that is, they were not altered from their ordinary appearance, although only in fragments. It is remarkable that this entire cranium should thus change while all the other bones, even the jaw, had disappeared. The description of this find is from Dr. Dinsmore, who has the skull in his office. Possibly he may be in error in stating that traces were found of other bones belonging with it. These may have belonged to another individual. The soil is ordinary sandy loess, containing lime but not in such quantity as to account for this alteration. Perhaps the skull may be from an older burial somewhere, the petrifaction having taken place before it was buried here.

RULO, NEBRASKA

Particular attention was paid to conditions a mile north of Rulo, where it is reported that human skeletons were found in the Kansan drift. It was not the intention of the discoverer to have it under-

stood that these remains were in undisturbed drift, but such is the impression that has gained credence.

At the settlement of the country by whites the road constructed across a ravine here, on the section line nearest the river about three-eighths of a mile away, followed the natural contour and the crossing was made without difficulty. Since then a deep washout has worked its way to some distance above this point, making a long bridge necessary. From the head of the washout to the Missouri River the banks are vertical, or nearly so, on each side of the little stream. It was in the bank on the south side that the bones were found. It is stated they were 7 feet under the surface; if so there must have been a mound above them, for the lowest excavation does not reach over 5 feet below the present level of the ground, and at that extends slightly below the bottom of the grave.

Within 40 years the Missouri River, which is now more than a mile away toward the Missouri shore, flowed at the foot of a slight bluff terminating the slope from the high land toward the west; there was formerly a steamboat landing on the upper side of the ravine. On the lower side is a triangular area of about an acre, bounded by the bluff, the river bank, and the ravine. This was an excellent location for an Indian village or camp. A narrow level strip extends from the mouth of the ravine to a point near the bridge, some distance above where the remains were found. It is quite clear that the skeletons were the remains of individuals who had died at the camp on the river's bank and had been carried here for burial. This may have occurred within the last hundred years or in fact at any time while the Indians were still living in this vicinity.

The flood level of the Missouri is not more than 15 feet lower than the level space along the sides of the ravine. The little intermittent stream has cut down this depth through a deposit which is composed of river sediment, wash from the hills on each side, and material carried from higher levels by the brook itself in rainy seasons. At only one point is there a real glacial deposit, and this does not extend for more than 50 feet horizontally, and does not reach to the top of the bank. It is at some distance from the graves, and may be due to a lobe of the ice or to an iceberg. However formed or deposited here it has no relation whatever to the skeletons. In a sense, the material in which they were buried is "Kansan drift"; but it is drift which has been redistributed and has come into its present position within a few centuries at the most.

NEAR HOWE, NEBRASKA

Mr. Sam P. Hughes, who lives near Howe, has done considerable excavating in that vicinity. He is an intelligent man and an ardent student, but his ideas in regard to the age of his discoveries need

much revision downward. His chief work has been done north of Howe at a place 9 miles from the nearest point on the Missouri River. Here is a small level area at the end of a ridge sloping away in every direction except at the narrow isthmus connecting it with the fields beyond, which are at a level only slightly higher. Thus there is no chance for any accumulation from the adjacent surface. On this ridge are a few lodge sites which Hughes has excavated. In every respect they are similar to lodge sites reported from other localities in this region. The walls, the depression, the floor, the fireplace, are all the same. The depressions are filled with earth to a depth of 18 to 22 inches above the level of the old floor; and Hughes reports that wherever he has dug on this ridge he has found flint chips, charcoal, fragments of pottery, and scraps of bone to about the same depth. Next below the soil is the Kansan glacial drift; but the assertion that objects found at this depth are of the same age as the drift is not necessarily or even presumably correct.

PERU, NEBRASKA

On various hills in the vicinity of Peru are lodge sites, some of them circular, some rectangular, some with straight sides and rounded corners. Most of them have been dug in at random; in every case after a certain depth of accumulated earth and trash is passed through, there is a layer of clay which formed the roof, and beneath this the hard earth floor with fireplace usually in the center but sometimes a little toward one side.

PAPILLION, NEBRASKA

At the time of my visit, Dr. Frederick H. Sterns, of the Peabody Museum, was working near here. He described himself as "the man who is extremely anxious to find a glacial or other very ancient man, but so far has not succeeded in getting track of him." Dr. Sterns did not claim a period antedating the Indian for anything he had then unearthed—meaning the known Indian tribes.

VICINITY OF OMAHA, NEBRASKA

To the southward of Omaha are many lodge sites of varying depths and diameters. The deepest one reported had a depth of 9 feet below the surrounding surface, and at the bottom of this was a pit (or "cache," as they are locally known) with an additional depth of 4 feet, or 13 feet of excavation in all. This was near the so-called "cannibal house," where 14 human frontal bones were found under conditions which indicate they had belonged to individuals who were eaten by other inmates of the lodge.

A short distance from these sites, across a ravine, is a bare, narrow ridge, very steep on each side, so that erosion would readily act. On the sloping summit of this are three small mounds which cover communal burials. From one of these, the one farthest from the summit of the hill, more than 80 skulls were taken and boys in the neighborhood have since taken many more. They are all of the ordinary Indian type, and can not have been buried more than a few generations ago; but this fact has not prevented an age of "twenty thousand years" being assigned to them. There is absolutely no reason for fixing this or any other date. There is nothing whatever to indicate the age, but 200 years would probably not be far from the mark, because erosion has been slight since the mounds were piled up.

LONG'S HILL

This ridge has attained some notoriety as the site of Gilder's discovery of the "Nebraska Man." The claim is made that human bones were found at a depth of 14 feet in absolutely undisturbed loess. The hill is a narrow ridge, facing the river on one side and a deep ravine on the other. It is somewhat winding in its course and is connected with the more level land in the rear at about half a mile from its end. A wagon road up the point, from the river bottom to the hilltop, shows undisturbed loess the entire distance. There is no possibility of accumulation by wash or in any other manner except decaying vegetation on any part of this ridge.

Along the crest are several small mounds. Some of these, as shown by excavation, cover graves, and the presumption is that all of them mark burial places.

It is needless to make any résumé of Gilder's report, as it is so well known, further than to say that he found burials and fragmentary human bones at various levels from 2½ to 14 feet. At 4½ feet were burned bones lying upon burned earth and mingled with it. This layer, burned hard as a brick, served to prevent water from penetrating the earth immediately below; and it is in this earth that the deepest remains were found.

There are three ways, and only three, in which they could get there:

1. They were washed in when the loess was deposited, as claimed by the discoverers and by some of the Nebraska geologists.

In support of this view is the assertion that the bones were waterworn. On this point I can not venture any opinion, as I have not seen them. But I have found bones in mounds and in other situations where such wear was impossible and yet having the smoothed and rounded appearance characteristic of such action by water or the elements.

In support of this theory, too, is the positive statement of Nebraska geologists who have had ample opportunity to become familiar with loess in all its phases; and they claim the deposit is the original and has not been disturbed.

It is necessary for these advocates, however, to tell where such fragments of bones could have come from and how they could have been washed to the place where found, when all these bluffs were covered with water, as they had to be at that time.

2. The bones could have been carried by rodents into their burrows or runways, as Hrdlička suggests. In this case the material in contact with the bones would have to be somewhat different in appearance and consistency from that which lay a few inches, or perhaps only an inch, away. The Nebraska men say this was not the case.

3. There may have been an excavation or pit similar to that in which the Hurons buried their dead. But as no such burial pits have been discovered in this part of the country, this supposition must be excluded.

A corollary to the last is that a deep but small pit similar to the so-called "caches" in the lodge sites may have been dug here and the bones thrown in. There is no indication whatever of a lodge site or any other form of habitation at this point, but I have found such pits in the vicinity of Indian houses, though not just on their site. The deepest one I have ever found was 10½ feet and less than 6 feet in diameter. There would be no difficulty in digging into this loose material as far as an excavator cared to go, until he had reached a depth at which he could no longer get the loosened earth to the surface of the ground. As mentioned above, a pit south of Omaha had a depth of 13 feet, or only 1 foot less than is claimed for this—or rather for the greatest depth at which it is claimed fragments of bone were found.

The objection made to this theory is that the earth thrown out of the hole was unmixed, presenting throughout the appearance and consistency of loess as it occurs where exposed in ravines or on slopes in the vicinity. It is contended that if any previous excavation had been made here and filled up afterwards the mixed earth would be easily distinguished from that which was not removed, and that the line of demarcation would be easily discernible.

As a rule, this is true; but when dry loose earth of homogeneous consistency is thrown out of a pit and then thrown in again without becoming mixed with any other it is sometimes impossible to distinguish it at a later excavation. This is especially true of earth free from vegetable matter, as ordinary sand; or composed largely of vegetable mold, as the soil in overflow lands which have built up

mainly from floods carrying uniform soil sediment. The line of demarcation between the dug and the undug earth in such conditions may become indistinguishable except when a vertical face is made which shall show a clear section of both in contact.

It is now too late to learn anything about the matter from the site itself. So many persons have been digging that it would be impossible to know when the limit is reached between the original excavation—assuming it to have been made—when the bodies were interred, and that resulting from the modern researches. The question of age hinges upon the appearance of the earth in which the bones were found; and the only way in which we can now learn anything about it is to trench across the hill at some of the other burial places, in the hope of finding bones at a similar level, and determining from the conditions in which these are found how they came there.

It is beyond question that any soil, humus, or other discolored matter thrown into an excavation with ordinary soil or subsoil will be apparent for an indefinite time afterwards. But on some of these high points and ridges there is even now not a trace of soil. Frost and wind have worn bare spots where nothing grows or has grown for a long time. As this region was a prairie devoid of even brush when the whites settled here, it is evident that such slight protection as grass or weeds afford would not be sufficient to hold the earth in place in winter, and when the ground is once swept bare such humble forms of growth may not get a foothold in future. Anyone who has studied surface geology knows these facts.

So at present the whole question of the age of these bones resolves itself into a statement of one party that they were found in undisturbed loess, as reported; and of the inability of another party to show that there may have been an error of observation or a mistaken interpretation.

There need be no such doubt in regard to the age of the mounds or the lodge sites. It would not take many centuries for mounds upon these sharp, exposed ridges to be entirely washed away, in spite of the fact that the fine loess is almost impermeable. Rain may not reduce them to an appreciable extent, but frost and wind will gradually wear them down. As to the lodge sites, their similarity to modern Indian houses is so pronounced that we are fully justified in attributing them to the same degree of culture as that of the Indians of a century ago. The only point of difference is that the latter dwellings have not such deep excavations, but the incursions of warlike tribes, or the restlessness that impels a primitive community to be frequently on the move, seems a simpler explanation of the difference than to suppose that identical types are separated by a great period of time.

Three points must be taken into consideration in fixing a definite age for these remains:

1. The relics found in and around the lodge sites, except for the markings on some of the pottery, are in no wise different from those picked up on the sites of villages which were occupied when Lewis and Clark came through here.

2. Fairly solid bones of animals, and occasionally of humans, are found in the bottoms of the lodge sites, even where these are damp most of the year. In the pits, where such remains are preserved by ashes, this would not mean much; but where they are found in clayey earth it is evident that "thousands of years" is a meaningless term to apply to them.

3. Persons who claim these "thousands of years" for pretty much everything they find in the ground must explain why it is that while the bones and implements of these assumed "ancients" are found in such quantities and in such good preservation, those of later Indians should have entirely disappeared.

The only tenable theory of age is the amount of accumulation in the depressions of the lodge sites. Above the clay which formed the roof, and is next to the floor now, is a depth of material sometimes (it is said) as much as 20 or even 22 inches of mingled silt, decayed vegetation, and soil from the surrounding wall. It is used as an argument of age that as these sites are on hilltops where there can be no inwash, this depth must indicate a very remote period for their construction. But a large amount of the earth thrown out into the surrounding ring or wall will find its way back into the depression. The water will stand in them a good part of the year, and the soil remain damp even in prolonged drought; vegetation is thus more luxuriant than on the outside, and its decay will fill up rather rapidly. In addition, much sand blows from the prairies as well as from the bottom lands, and whatever finds its way into the pit will stay there; it will not blow away again as it would in open ground. The weeds, also, will catch and retain much of this dust which would pass over a dry surface. Consequently the allowance of an inch in a century, which is the most that advocates of great age will allow for accumulation, is much too small.

The topography of the region was essentially the same when these remains were constructed as it is now. The hills and valleys were as they now exist; the erosion has been very slight as compared with what has taken place since the loess was brought above the water, to which it owes its origin. This statement is fully proven by the position of the mounds and lodge sites. Any estimate of age must be only a guess at the best, but it is a safe guess that no earthwork, mound, lodge site, or human bone along this part of the Missouri River has been here as long as 10 centuries.

IV. ABORIGINAL HOUSE MOUNDS

The small, low, flattened mounds of the lower Mississippi Valley are a problem to archeologists. They have been studied principally near the Mississippi River, in Arkansas and Missouri, and for many years it was thought that in the latter State they are confined entirely to the southeastern portion. Recently they have been found much farther to the north and the west than they were supposed to exist.

A group, rather limited as to number and to the area covered, is at the head of a narrow valley trending northward from Granite Mountain in Iron County.

"Near Iron Mountain, in St. François County, more than 500 of these small mounds, arranged in parallel rows following the direction of the watercourses, were counted within a radius of 3 miles."[1]

The next group known north of this is on the right bank of Plattin Creek in Jefferson County, about 12 miles from the Mississippi.

"A group of some 50 similar mounds is situated on the right bank of the Meramec, about 6 miles above its mouth, in Jefferson County."[1]

The most northern group so far observed is near Ferguson in St. Louis County, Missouri, where 46 are located on a narrow ridge which has the same general elevation as the table-land. The ridge extends around the head of a ravine, and the mounds are placed along its crest or on the gentle slopes near the top. There are 10 or 12 at the southern edge of Ferguson, on an overflow bottom bordering a small creek.

Toward the west from the swamp region a small group is in a broad valley near Alton in Oregon County, which borders on Arkansas. They are scattered along a gentle slope which has a little stream at the foot.

In Dent County four groups are known. One is on the infirmary farm south of the town of Salem. Most of these are but slightly changed from their natural condition. Another group is 6 miles east of Salem. These also are largely intact. A third is on the road from Salem to Short Bend. The fourth is at the edge of Salem, on the Rolla road.

"On the high plateau of Dallas County, north of the Niangua . . . within an area smaller than 10 square miles, 860 were counted."[2]

[1] Bushnell, D. I., jr., Archeology of the Ozark region of Missouri. Amer. Anthrop., n. s. vol. 6, no. 2, p. 298.

[2] Ibid., p. 297.

Three groups are well marked in Phelps County. A mile east of Rolla they begin at the line of the Frisco Railway and extend southward in a shallow valley or "draw." Some are on the overflow flat bordering the little stream, but most of them are on the slopes to either side.

South of Dillon they extend for a mile in a slight depression.

Beginning at the Soldier's Home in St. James, the largest number yet found out of the swamp region lie for 2½ miles on both sides of a small creek running eastward north of the Frisco Railway. These reach from low land subject to overflow to an elevation of fully 50 feet up the hillsides.

Several groups occur in Pulaski County. Four miles southwest of Big Piney post office, near the site of what is known as "The Ranch House," is a little wet-weather stream along both banks of which are probably a hundred of these structures. Farther up this stream are two other groups, the three including a distance of about 4 miles in length between their outer limits. West of these and south of Bloodland is a fourth group belonging with these.

In the level bottom between Big Piney River and the branch flowing from the Miller Spring 2 miles from Big Piney post office a number of these mounds formerly existed; and on the opposite side of the Big Piney, in an extensive bottom, were many of them. All these have now disappeared under cultivation.

On the outer bend of the Devil's Elbow, on Big Piney 3 miles above its mouth, some of these mounds stood. They are described as being from 2 to 3 feet high; the number was not stated, but there is not room for many in the narrow strip where they were located.

In the extreme western part of Morgan County, at Stover, is a group scattered over an area at least half a mile across in any direction. The distance between the mounds varies from 25 to 150 feet. They are mostly on gentle slopes, though some are on the crest of the ridges. Many of these are well preserved, some of them having never been under cultivation.

In Osage County there are more than a hundred at the eastern edge of Rich Fountain. They are in low flat ground which is muddy or even boggy in wet weather.

It will be noticed that all those from Alton westward and northwestward are in line with the route from southeastern Missouri to the plains of Kansas and Nebraska.

Practically, however, the northern limit of this type, in great numbers, is in St. François County, near Farmington. From here they extend almost continuously into Louisiana and Texas.

In nearly every part of southern Missouri east of the Iron Mountain Railway they occur in closely connected groups, reaching sometimes for miles except where the continuity is broken by a slough or other

unfavorable condition. They are found everywhere—on high, well-drained levels; on sloping ground, sometimes so steep that it may well be called a hillside; in low "crawfish land"; in swamps where, in the driest weather, even after a prolonged drought, they can be reached only by wading through water or muck. The last, however, may have been more easily accessible when built, their present condition being due to the general subsidence of this region during the earthquake period of 1811. The existing sloughs and sluggish bayous are the widenings and extensions of streams which at the time these mounds were constructed were no doubt bordered by banks above ordinary overflow and readily reached by canoes. Manifestly the country was well populated, and therefore presumably practically timberless; consequently the flood water would rapidly pass away and the streams not be choked by drift and other débris as is the case at present.

Various theories, most of them advanced by persons who are but slightly, if at all, familiar with the country, have been propounded to account for mounds of this character. Their vast number has led some writers to believe that they can not be artificial but must be due to natural phenomena; as, for instance, that these, as indeed all mounds, were piled up by floods, Noachic, glacial, or local; or that they result from the industry and energy of burrowing animals, such as foxes, badgers, ground hogs, rabbits, prairie dogs, gophers, chipmunks, or even ants; the character of the assumed flood or the species of the supposed burrower depending to some extent upon locality, but principally upon the theorizer's insufficient knowledge of animal industry or of the action of torrential waters. Others are convinced they are formed by the piling up of earth around a bush, clump of grass, stone, or other object acting as a nucleus about which wind-borne material may accumulate—overlooking the fact that clay, gravel, or gumbo soil can not be carried by wind, and that lighter soil or sand will form elongated instead of circular masses. Another supposition is that they are due to stream erosion; flood waters washing away the soil between them and thus leaving the earth composing the mound in its original position. The same objection applies to this as to the wind-blown theory, namely, that we can not imagine water acting with such mathematical regularity and intelligent discrimination, especially upon slopes which lie at all sorts of angles with the trend of the current.

Persons who recognize their human origin have suggested that they were erected as stands for hunters, from which they could detect game at a greater distance, or could take better aim as the animal passed; or perhaps as camping places while waiting; but in many places more than half the area of the ground over several

acres is occupied by such piles of earth, promiscuously distributed. This implies more hunters than animals.

For a long time it was supposed that they were burial mounds, like so many such structures found over the country; but this idea has been dispelled by the failure to discover in them any evidences of such purpose; no human bones nor any of the artificial objects commonly placed with the dead have ever been found in them unless under such conditions as to show their presence was accidental.

Two very plausible theories have found general acceptance: That they were the sites of dwellings, placed on them to be out of the mud in wet weather; and that they were in the nature of garden beds, thus elevated for growing any food products which needed a comparatively dry soil, or might be injured by temporary accumulation of water from excessive rainfall.

But they were not "residence mounds" or "house sites" in the sense that they furnished a base or foundation for structures which were used as dwellings; for there has never been found on their surface or in the earth immediately around them any of the débris invariably accompanying Indian huts or houses, such as fireplaces, ash beds, burned rocks, broken implements, or fragments of bones and pottery. These considerations also interfere with a full acceptance of the hypothesis that they are remains of houses built of wood and covered with earth. It is true that such evidence is very frequently found in other localities; but to establish the fact that they were residence sites, refuse of this kind should be found wherever the mounds occur.

J. B. Thoburn arrived at this conclusion from the resemblance of some of them in their outlines to the grass-covered houses of the Pawnees; and it is believed that this tribe in its migration from the south followed approximately the route along which these small elevations are found. When the Pawnees—assuming they were the builders—passed on westward they could not procure timbers of sufficient strength to hold up the earth, so they used light frames and covered them with grass.

Bushnell arrived earlier at the same conclusion. He says, concerning a few mounds of this character in Forest Park, St. Louis: "In the case of the seven mounds on the elevated grounds, the finding of potsherds, pieces of chipped chert, and the indication of fire, all on what appeared to have been the original surface, would point strongly to their having been the remains or ruins of earth-covered lodges." He gives citations from early explorers in support of this theory, and adds, "But in other mounds these indications did not occur."[3]

[3] Papers Peabody Museum, vol. III, no. 1, p. 16.

Such an explanation finds support in the vast number of these structures. In building, the aborigines naturally chose the sort of timber which was soft and light, consequently easy to cut and to handle, such as willow or cottonwood. This soon decays. But no matter what variety of wood was utilized, not many years would be required, under the conditions supposed, to weaken its fiber until it could no longer uphold the weight of earth on the roof, and a new house must be erected. Several such renewals would be needed in the course of a century; so that the ruins of an ordinary village might create the impression that a large settlement had existed on its site.

The explanation of "agricultural use" is probably correct in some instances, for frequently the mounds are made of earth gathered up around their base, and so not only would be of value in a wet season, but would afford a much greater depth of fertile soil for sustenance of plants. In some localities modern farmers find that on such mounds crops are much better than on the low spaces between them. On the other hand, a majority of the small mounds in the lower counties of southeastern Missouri are composed either of the hard, reddish, sandy clay which forms the subsoil of the land above overflow; or of the tough, waxy, black "gumbo" of the swampy or flat lowlands. In either case they are almost invariably sterile, so that in a cultivated field the position of a mound is easily determined even from a considerable distance by the feebler growth on its surface. Moreover, in many places, hundreds of them occurring within an area of a few square miles are built on clay lowlands where crawfish abound, within a few rods of sandy, well-drained ridges whose soil is never muddy more than a few hours after the hardest rain, and produces as fine corn and wheat as can be raised in any part of the State.

In short, no matter what suggestion has been offered as to their purpose or uses, objections to it can be brought and sustained. It is not improbable that, in the end, it will be found the difficulty lies in trying to place in a hard and fast category a variety of structures which are similar in appearance but which were intended for various uses. With more comprehensive study, it may be that a classification is possible which will interpret what is now obscure. Instead of uniformity, there was probably great diversity of motives, ideas, and beliefs which led to the building of these as well as of other mounds; and when the key is once obtained the explanation which will account for one may be very different from that which as clearly accounts for another.

A few of these mounds have been explored by the writer, but no discoveries were made upon which can be based a definite statement as to their probable purpose.

NEW MADRID COUNTY

On the farm of A. B. Hunter, 7 miles north of New Madrid, more than 60 of these mounds, irregularly placed, extend for half a mile along the west bank of St. John's Bayou, the extreme width of the group being about 200 yards. The largest mound, standing on the edge of the terrace, was 6 feet high and 75 feet across. On the original surface, over a small area at the central part, were decayed fragments of human bones; so this was probably erected as a tumulus. The others were much smaller; from a foot to 3 feet high, and 30 to 50 feet in diameter. Six of these, varying in size from the largest to the smallest, were thoroughly excavated within the original margin and down to the undisturbed earth beneath them. No artificial object was found in any of them except here and there a fragment of pottery or a small amount of ashes or a piece of charcoal, not intentionally deposited but gathered up and carried in with the earth in the course of construction. There were no distinct firebeds or ash piles at the bottom, or in any part of the mound; nor were there any holes in which posts may have stood.

ST. FRANÇOIS COUNTY

Nearly 2 miles south of Farmington, on Quesnel's land, are about 30 very small, low mounds, none more than 18 inches high or 25 feet across. They are on the general level, some of them on a gentle slope, of the first upland above the St. François River and a mile from that stream at its nearest point.

Half a mile to the south of these is a group of similar mounds on the farm of Isaac Hopkins, on a gently sloping hillside, and from 30 to 40 feet above the level of the overflow bottom land. One of these has been gradually worn away by the encroachment of a gully until more than half of it has disappeared. While the curvature of its surface is very apparent, and the remnant of its margin sufficiently distinct to show its regularity of outline, careful inspection of the face formed by the erosion fails to reveal any trace of stratification, or line of demarcation between the bottom of the mound and the original surface. There is precisely the same uniformity of change from the grass roots to the underlying gravelly soil that exists in the exposed bank at any point to either side of the mound. Mr. Hopkins, desirous of knowing what might be in the mound, or why it was built, has noted the appearance of the earth from the time the gully reached its margin. At no time has its appearance differed in the least from what it presents now.

On the river bottom portion of Mr. Hopkins's farm, and on the adjoining Goings and Townshend farms to the southward, are many mounds lying along both sides of the Belmont division of the Iron

Mountain Railway. Fully 100 were observed within a distance of a mile; and they are said to continue both up and down the river. They are all above flood stage, except in time of extreme high water. They range from a foot to 3 feet high, and from 20 to 40 feet across; but some of them have been lowered and broadened by cultivation. They are of the same earth as the ground around them. Mr. Hopkins says crops are much better on the mounds than on the area between them. This is no doubt due to the greater amount of productive soil in the one case, and to the excess of moisture in the other; the railway embankment impeding drainage in the lower part. Oak trees 4 feet in diameter grew on the mounds before they were cleared off.

Two of these mounds were completely removed, down into the subsoil. The first was 18 inches high and 35 by 40 feet across; the variation in breadth resulting from continual cultivation in one direction. It contained nothing whatever of artificial character, not even a scrap of pottery. There were no post holes, no indications of a fire bed, no trace of a distinction between the mound and the soil below it. In fact, except for the greater thickness of the superficial dark earth there was no difference between the appearance of the face of the excavation and that of a hole dug at random in the field.

The second mound was somewhat larger than the first, being 2 feet high and 40 feet across, and at a little higher level toward the edge of the field. It was the largest which could be excavated of this group. As in the first mound opened, there was no worked object, if a small flint flake be excepted; no ashes; no fire bed; no trace of demarcation between the mound and the original surface of the ground, though in each mound the excavation over the entire area was carried down into the gravelly, hard-packed subsoil. Its artificial origin is clearly proven, however, by four holes dug into the earth beneath it before its construction. Nine feet a little north of the center, which was assumed to be the highest point of the mound, was a hole (A) 12 by 14 inches and 14 inches deep, with a flat bottom, the sides as regular as could be expected in hard soil dug out in primitive manner. Nine feet west of the center was a hole (B) a foot across, 10 inches deep, with a solid though somewhat irregular bottom. Near the center was a conical hole (C) a foot deep and the same across the top. Four feet from it, west of north, was another (D) of about the same size and shape. The measures given are of course only approximate, as the sides of all the holes were somewhat uneven, but they are practically correct. The depth was measured from the top of the gravelly subsoil. Fourteen feet east of south from the center was an irregular hole (E) about 2 feet deep to the bottom of the loose dirt in it. This had not been dug, but was

due to the decay of a tree which grew here before the mound was made. At the top of the dirt filling this hole was a piece of decayed bark, apparently oak, which had grown in the air; and farther down fragments of root bark. Eight feet east of the center was a hole (F), similar to the last, 10 inches deep and averaging 2 feet across. This, also, resulted from the decay of a stump.

A plan of the holes is given in figure 37. The dotted lines are merely to show direction and distance.

This mound offers confirmation of the belief that such structures, or some of them at least, mark the sites of dwellings. With the two trees, E and F, the posts, A and B, would form the corners of an irregular quadrangle; the two posts, C and D, would support the inner ends of roof timbers. While no trace of posts or roof timbers remained, it is difficult to imagine for what other purpose these holes would be dug; and in this heavy, wet earth all traces of wood must in time disappear. Conversely, the total absence of a fireplace, potsherds or other remains, and of any sign of a floor, would serve to dispel the assumption that this spot was ever inhabited even for a short time. The evidence is as strong one way as it is the other.

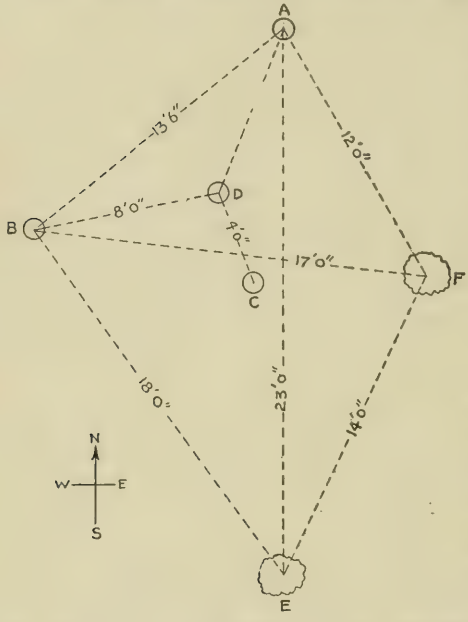


FIG. 37.—Plan of House Mound in St. François County, Mo.

In short, the limited observations above recorded leave the question of origin and purpose just where it was.

Some years ago one of the mounds at Ferguson, St. Louis County, was opened. No remains of any sort were discovered, according to the report of the excavators; but on the original surface, at the center of the mound, was a fire bed in and about which were ashes, charcoal, and fragments of rude pottery.

No excavations have ever been made in the mounds near Granite Mountain; but a tortuous little stream has undercut several of them, thus making vertical sections as in the case of the mound at Hunter's, near Farmington. In some mounds only a small portion near the mar-

gin has been removed; in others the erosion has progressed to such an extent that observations were possible at varying distances, to and beyond the center. In every instance a monotonous uniformity of appearance prevails from the top of the mound into the underlying gravel. At no level is there a sign of a floor, fire bed, or other evidence of human work; and no difference can be detected between the earth upon which the mound rests and that on either side. Yet the mounds are indubitably artificial.

Exactly the same remarks apply to several mounds on the County Farm, near Salem. A little creek and a drainage ditch have cut away varying portions of them, and they merge insensibly into the soil and gravel on either side.

In further support of the theory that these mounds are the remains of earth-covered houses, a few extracts relating to the area under discussion will be given from Dr. Cyrus Thomas in the Twelfth Annual Report of the Bureau of Ethnology:

Near "Beckwith's Fort," in Mississippi County, Missouri, are (p. 189)—

> Low, flattish, circular mounds * * * [which] appear to belong to two classes, those used for dwelling sites and those used for burial purposes, the former being the higher and the color of the surface layer darker than that of the other class. This darker color of the surface layer is probably due to the fact that immediately below it are found fire-beds with burnt earth, charcoal, ashes, and the bones of animals, (mostly split). There are seldom any human skeletons or entire vessels of pottery in the mounds of this class though the earth is filled with fragments of broken vessels.

In describing mound excavations in Crittenden County, Arkansas, the explorer states (p. 227):

> As an almost universal rule, after removing a foot or two of top soil, a layer of burnt clay in a broken or fragmentary condition would be found, sometimes with impressions of grass or twigs, which easily crumbled but was often hard and stamped apparently with an implement made of split reeds of comparatively large size. This layer was in places a foot thick and frequently burned to a brick red or even to clinkers.
>
> Below this, at a depth of 3 to 5 feet from the surface, were more or less ashes, and often 6 inches of charred grass, immediately covering skeletons. The latter were found lying in all directions, some with the face up, others with it down, and others on the side. With these were vessels of clay, in some cases one, sometimes more.

The positions of the skeletons in this mound would indicate that while the inmates of the house were asleep the roof fell and killed them. It was customary among some southern Indians to bury the dead under the floors of the houses; but the text clearly shows that these skeletons were lying on the floor. It would be supposed from most reports, not only in the volume quoted, but from various other sources as well, that only the walls of these houses were plastered with mud, the roof being of thatch alone. It seems to be over-

looked that the tops of the houses would have even more need of such protection than the sides. The marks indicating that the clay was "stamped apparently with an implement made of split reeds" are only the impressions of the reeds or saplings by which the clay was supported; the "brick like" or "clinker like" condition of the clay being due, of course, to the destruction of the house by fire.

Adair, in his History of the Southern Indians, says they daub their houses with tough mortar mixed with dry grass; that they build winter or hot houses after the manner of Dutch ovens, covered with clay. Again:

> They are lathed with cane and plastered with mud from bottom to top, within and without, with a good covering of straw.

This seems to mean that the entire building was plastered with mud, and then covered with grass to shed the rainfall.

In a mound in Arkansas County, Arkansas (Twelfth Ann. Rept. Bur. Ethn., p. 231)—

> About 2 feet under the surface was a thick layer of burnt clay, which probably formed the roof. In tracing out the circumference a hard clay floor was found beneath, and between the two several inches of ashes, but no skeletons. There were a great many pieces of broken dishes so situated as to lead one to believe they were on top of the house at the time it was burned.

The fact that no skeletons or utensils were discovered on the floor finds its most reasonable explanation in the supposition that the inmates, finding their abode to be unsafe, moved out and took their possessions with them. This would account, also, for the absence of such remains in similar mounds farther north. The abundance of pottery fragments found in this case, and in many others, may mean only that these were worked in as a part of the clay roofing. They would be of some service in holding the clay in place in wet weather.

It is quite probable that the continuous, though fragmentary, layer of burned clay on the floor so often noted is due in part at least to the material forming the roof. The walls would be more apt to fall outward than inward, and would be more liable to crumble than to fall as an intact mass. In fact, this is clearly shown by the statement (p. 229) that in certain house sites in St. Francis County, Arkansas,

> The edges are all higher and have a thicker layer of this [burned] material than the inner areas.

Further, in describing explorations of certain "hut rings" at "Beckwith's Fort" in Mississippi County, Missouri (p. 187), the report states that they are

> from 30 to 50 feet in diameter, measuring to the tops of their rims, which are raised slightly above the natural level. The depth of the depression at the center is from 2 to 3 feet. Near the center, somewhat covered with earth, are usually found the baked earth, charcoal, and ashes of ancient fires, and

around these and beneath the rims [that is, the surrounding ring or embankment] split bones and fresh-water shells. Often mingled with this refuse material are rude stone implements and fragments of pottery.

Note is made of

the similarity in the size, form, and general appearance of these depressions and earthen rings to those of the earth lodges of the abandoned Mandan towns along the Missouri River.

It appears, too, that certain sites were occupied for long periods, new houses being constructed when necessary. In describing mounds in Poinsett County, Arkansas, the same writer says (p. 205) that

The positions and relations of these beds * * * make it evident that upon the site of one burned dwelling another was usually constructed, not infrequently a third, and sometimes even a fourth, the remains of each being underlaid and usually overlaid in part by very dark, adhesive clay or muck. * * *

The peculiar black color of these beds is chiefly in consequence of the large proportion of charcoal with which they are mixed, some of it doubtless the fine particles of burned grass and reed matting with which the cabins appear to have been thatched.

These layers of "very dark" material undoubtedly are remains of mud from the adjacent swamps, which was mixed with or plastered over the grass roofs. It is difficult to understand how they could have become mixed after the burning.

As showing the extent to which this prolonged occupancy was carried, we are informed (p. 254) that in Coahoma County, Mississippi, a mound was—

oval and rounded on top, 210 feet long, 150 broad at the base, and 16 feet high. This mound and several smaller ones near it are so nearly masses of fire beds, burnt clay, fragments of stone and pottery, together with more or less charcoal and ashes, as to indicate clearly that they are the sites of ancient dwellings thus elevated by accumulation of material during long continued occupancy.

In still other portions of the country besides those already mentioned are evidences of similar houses whose sites are now marked by mounds. In southern Ohio, especially, records of excavations contain numerous references to post holes under mounds both large and small. In the case of the former, so far as we may judge from the reports, the houses were destroyed before the mounds were built, and it does not appear that they were ever covered with earth. In the small, low, flat mounds, under which such holes existed, no thought was taken that these may mark the position of posts used to support a roof; all mounds were explored with the idea that they were for burial purposes, consequently no attention was paid to these features.

The Mandan houses, as described by Lewis and Clark, Catlin, and others, when fallen into ruins would leave exactly such mounds or hut rings as those found in Missouri and Arkansas.

It is now generally conceded that the wall or embankment at Aztalan, Wisconsin, concerning which so many wild theories have been promulgated, was simply a series of such house sites connected by a low ridge. The evidences of mysterious sacrificial altars seem to be due only to the destruction of such houses by fire.

In Wisconsin, also, and in Minnesota, are many small mounds apparently of this character which are due to an extinct tribe known to the Sioux and Chippewas as "The Ground House Indians."

In 1887 I became acquainted, at Munising, Michigan, with Mr. William Cameron. He was of the Scotch clan of Camerons, a nephew of a former Governor of Canada. Educated for a profession, he made a visit to relatives in Canada in early manhood, and the attractions of the wilderness proved so great that he never returned to his home. At the time I met him he was 84 years of age, in full possession of his mental faculties. For more than 60 years he had traversed the Lake region, his fur trading and trapping expeditions having carried him over all the country from Montreal to the mouth of the Mackenzie River. Much of his life had been spent among the Indians, especially the Sioux and Chippewas. He learned from them all they could tell him of their tribal history and former methods of living. The Chippewas told him that when they first came into the country they found the Sioux in possession, but finally, obtaining arms from the French, they drove the Sioux westward.

The "old men" of the Sioux corroborated this tradition and told Cameron that as they went westward they came to a race of people who lived in mounds which they piled up. These people were large and strong, but cowardly. "If they had been as brave as they were big," said the Sioux, "between them and the Chippewas we would have been destroyed; but they were great cowards and we easily drove them away."

Mr. B. G. Armstrong, of Ashland, Wisconsin, told me that he had taken great pains to investigate this tradition. From all that he could gather by much inquiry among the Indians and from his own observations, he was satisfied of its correctness. These people, whom the Sioux called Ground House Indians, built houses of logs and posts, over and around which they piled earth until it formed a conical mass several feet thick above the roof. Their territory extended from Lake Eau Claire, about 30 miles south of Lake Superior, to the Wisconsin River near Wausau or Stevens Point; down the Wisconsin a short distance; thence west into Minnesota, but how far he could not say; then around north of Yellow Lake back to the Eau Claire region. The Sioux exterminated the tribe, the last survivors being an old man and a woman who had married a Sioux. They were taken to the present site of Superior, near Duluth, and "died

about 200 years ago"—that is, in the last quarter of the seventeenth century.

Gordon, an intelligent Indian living at the town of the same name, a short distance south of Superior, was familiar with this tradition, as were other Indians with whom I talked, and who accepted it as a well-known fact. Gordon related that he had heard "the old men" say these Indians erected their houses of wood and piled several feet of dirt over them; and they buried their dead in little mounds out in front of their houses and a few hundred feet away. He told of a mound that was opened near Yellow Lake in which the position and condition of the skeletons, two or three of children being among them, showed "as plainly as anything could" that they had been sitting or lounging around the fire, when the roof fell in and crushed them.

There is a "Ground House River" in eastern Minnesota, which probably derives its name from this people.

V. ARCHEOLOGICAL WORK IN HAWAII

INTRODUCTION

The ethnologist or archeologist desiring to conduct explorations on the Hawaiian Islands will find it necessary to begin his labors at the Bishop Museum in Honolulu. This museum contains an extensive collection of articles, classified, arranged, and labeled, illustrating every phase of native life as it has existed since the islands have been known to white men, as well as many of the implements and objects pertaining to agriculture, fisheries, and domestic occupations of earlier times. Models or casts of houses, and of individuals engaged in various lines of industry, give the visitor a clear idea as to the routine of ordinary daily life. A careful study of all these things enlightens him in regard to what he may expect to find and to the meaning of such discoveries as he may make.

The extensive library which belongs to the museum contains every publication relating not alone to the islands but to all the archipelagoes of the southern Pacific that it is possible to procure; and among the most valuable of the volumes are the reports and memoirs of the museum itself, in which are set forth the observations and deductions of numerous investigators who, either in behalf of the museum or under its auspices, have endeavored to find a solution for the many problems involved.

Equally valuable to the student are the information, interpretations, and instruction freely placed at his disposal by those connected with the museum, especially by Dr. Brigham, the former director, whose long and busy life has been devoted almost entirely to a study of the Polynesian groups; by Professor Gregory, the present director, who with tireless energy is the impelling force behind various lines of scientific research; by Mr. Stokes, curator of the ethnological department, who for more than a score of years has been surveying, photographing, and collecting in every part of the islands; by Mr. Thomas G. Thrum, of Honolulu, who has completed, in manuscript, a volume containing a list and description of more than 500 heiaus on the islands; and by various other men who, in private life, have devoted much time and close attention to whatever may pertain to native life and customs.

MOLOKAI ISLAND

Following the advice of those whose knowledge gave them authority to speak decisively, the initial base of research was the island of Molokai, which presents the best conditions for study. It lies off the usual lines of travel, offers no inducement to tourists who wish to have the benefit of good roads and comfortable hotels, and consequently is seldom visited except by those who are called on business or who go as the guests of the few residents there.

Mr. George Cooke, one of the owners of a large cattle and sheep ranch on the island, and greatly interested in its aboriginal history, gave most generous aid in a reconnoissance of such parts as he had time to visit. He placed his beautiful summer residence at the disposal of Prof. Gregory and the writer, and conducted the explorers to nearly all the places of interest which could be approached by automobile. Mr. James Munro, manager of the ranch, also rendered valuable assistance. Owing to his long residence here he has become thoroughly familiar with every noteworthy feature, and pointed out many remains which, without his guidance, would have been missed altogether. Fully acquainted with the life of the Hawaiian people, he made clear the origin and purpose of many things that, lacking his intelligent explanation, would have been without significance.

Although there are now comparatively few Hawaiians on Molokai, it is evident that the island at one time supported a dense population. Along the southern, or leeward, coast are numerous fish ponds formed by building a stone wall across an inlet or, more frequently, by constructing it with the ends on shore and carrying it around a section of the open sea. The walls are strong enough to resist the waves, well above the level of high tide, and surround spaces of various areas up to 70 acres. These ponds were stocked with numerous kinds of fish which, thus protected from their natural enemies, increased rapidly and formed an unfailing food supply. The antiquity of these ponds is denoted by the amount of silt partially filling them, brought down from the mountains by erosion of the soil. They are still used to some extent by Hawaiians as well as by other residents.

Inland, low walls of stone or earth, or both, surround hundreds of old taro patches, one variety of these plants requiring an abundant supply of water during its growth. The poi made from taro was the principal vegetable food of the inhabitants. Sweet potatoes were also a leading article of diet. The fields in which they were grown may still be identified here and there by the little ridges heaped up. All these, with the addition of migratory birds and fowls which at certain seasons swarmed on the different islands, supplemented by various nuts and fruits growing spontaneously, provided a varied and ample food supply. Mammals, except the pig, dog, and rat

(really a large mouse), which came in with the early natives, were unknown prior to the advent of the whites. There were no land reptiles and few indigenous noxious insects; although mosquitoes, not to mention certain domestic pests, abound in a few places, and there are some scorpions and centipedes; but these, like measles, smallpox, tuberculosis, and worse diseases, are adjuncts of an enforced civilization. The mongoose, brought in to destroy rats, and the myna bird, to devour insects, are themselves now beginning to be detrimental.

Along the coasts, on the headlands and lower hills, and to a less extent farther inland, are village sites, foundations of temples and houses, garden patches inclosed by stone walls, and long rows of stones, some of which are borders of roads or trails, others being for purposes which are undetermined. Among these, taro beds and sweet potato patches may still be traced.

The most remarkable among the remains are the great temple site on Senator Cooke's ranch, toward the east end of the island, and the "paved trail" 10 miles down the coast from Kaunakakai, the principal village and harbor. The former is rectangular in outline, built on irregular ground, of stones large and small, to form a level platform on which a thousand persons could assemble without being hampered for lack of room. The outer faces of the walls vary from 3 to 20 feet in height; and except at the lowest parts there are terraces or steps all around, about 5 feet in height and of differing width. Surrounding this platform, extending for half a mile up the little valley of which it marks the entrance, on the slopes to either side, and on the nearly level area reaching down to the sea in front, are all the indications of a populous settlement.

It is said that the ruins were formerly much more numerous and extensive, the larger part of them being swept out of existence by a great rush of water from the mountains "a long time ago."

The "paved trail" is a causeway of large stones. Some parts of it are obliterated by slides and encroaching ravines; other parts preserve the original condition and appearance. The width is not quite uniform, as the stones are of different sizes, but it departs very little either way from 6 feet. So far as can be judged in its present overgrown state, it extends in a straight line for about 2 miles, from the beach to a point on the hill at an altitude of fully 1,000 feet. To what it led, or why it was built, are questions awaiting an answer.

All of these places are now abandoned except a few villages along the coast. The people are not here to occupy them, and even if they were the conditions have become so changed that residence about them is no longer feasible. At the temple site, for example, the extent of the old taro beds predicates an abundance of water; at present, the one family living near by must carry it in a dry season

from the well or spring of a neighbor. There is no steady water supply within miles of the "paved trail."

Clearly, extensive changes have taken place in recent times in climate and perhaps in topography. Fifty years ago forests of large trees grew over hundreds of square miles on the southern slopes of Molokai where at the present time there is only grass, or where algaroba trees, similar to the mesquite of the southwestern United States, are now spreading. This deforestation is still going on; dead or dying trees fringe the timber still standing. The cause of this progressive barrenness has not, so far, been fully ascertained; there is undoubtedly a connection between it and the diminished water supply, though which is cause and which is effect, or whether both are due in common to some atmospheric phenomenon, is unknown. One result, however, is apparent. The roots of the forest trees do not extend deep into the earth, but spread out over the surface like those of pine trees. Thus much of the rainfall was prevented from escaping rapidly and such as was not absorbed by the roots made its way into the ground beneath the upper soil, whence it percolated downward to feed the springs. Now the greater part of the water runs off and is lost. For this reason large areas once well populated are no longer habitable.

Molokai, like other islands of the group, contains no stone except of volcanic or coral formation. There is no chert or similar material from which chipped implements can be made; nor, as would naturally be expected, is there any obsidian suitable for such manufacture. It may occasionally be seen on the sites of villages, but always in small angular fragments seldom more than half an inch in any dimension, always coarse-grained, even porous, and never of a quality which can be flaked into definite forms. No doubt its only use was as an abrasive, after being pounded fine. Rarely, quartz or chalcedony is found; it resembles the deposit around hot springs or in fissures, and, like the obsidian, is in fragments too small to be utilized except as a grinding or polishing material for smoothing wrought objects.

Manufactured stone specimens are confined principally to three general classes: Adzes, for working in wood; pestles, for pounding the taro root; and discoids, for games. The last are exactly similar to the chunkey stones so abundant in the States, except that none of them have concave or hollowed faces, and they are used in the same way. There were three forms of the game: To hurl or roll a disk farther than an opponent; to strike a pole or other mark set up; and to test the inherent magical powers of the stones by rolling them in such a way that they would collide, the object in this case being to see which one might prove victorious by breaking the other or forcing it out of its course. A suitable arena for the contest was prepared by

carefully leveling and smoothing a straight, narrow strip of ground to any length desired, a slight wall being thrown up along each margin.

Pottery was unknown, there being no clay suitable for making it. Calabashes or gourds and wooden trays served as receptacles, though stone dishes or bowls are sometimes found. Along the coast occur sinkers, either plummet-shaped or half-ovoid like an egg divided lengthwise. This form has a groove around the longer diameter, crossing the flat face, and was tied to a white shell as a sinker in catching squids or cuttlefish, a hook being attached to the line. Coral was much used as files or rasps. There are a few objects whose purpose is problematical; and some highly polished black disks which, laid flat and covered with a film of water, make excellent mirrors; but aside from what is here mentioned, not much worked stone is found. Wood, bone, and shell served as the raw material for nearly all other needs.

Graves, or what are supposed to be graves, marked by cairns 3 or 4 feet high, or perhaps by only one or two layers of stones, are found, though rare. Many so-called caves—which are merely "tunnels," "bubbles," or "blow-holes" in the lava—were utilized as burial vaults. The natives vigorously protested against an attempt to excavate any of these, claiming that their ancestors or members of their families are buried in them and must not be disturbed. In the dunes human skeletons are frequently exposed by the shifting of the sands by the high wind. The natives seem to have little regard for these. Perhaps they are of the "common people," while cairns cover the chiefs or priests. There is a tradition that in "the old times" most of the dead were cast into the ocean as an offering to the Shark God.

There are no mounds or other structures of earth; everything was built of stone. All structures began at the surface of the ground. No evidence has been found of an occupation earlier than that of the present Hawaiian people. At no point examined in ravines or cliffs was there the slightest hint of human life at a period antedating that beginning with the race discovered by Captain Cook. Consequently no extended excavations were attempted. The results of some examinations made in three different places will be presented.

About 10 miles in an air line from Kaunakakai and the same distance from Mr. Cooke's home, on a mountain known as Mauna Loa, is a narrow, sharp ridge extending nearly south and terminating abruptly at the junction of two deep ravines. On the end of this are two house sites, or heiaus, which had never been disturbed. They are as nearly rectangular as the irregular stones of which they are built will permit. The larger (A) has its south wall at the edge of the low cliff, with its sides nearly on the cardinal lines.

Omitting inches from the measurements, its outer dimensions are: North wall 38 feet, south wall 32 feet, east wall 33 feet, west wall 32 feet. The corresponding inside measurements are 21 feet, 19 feet, 21 feet, and 22 feet. Thirteen feet north from the north wall is a stone pile 13 feet north and south by 10 feet east and west, 18 inches high. Ten feet west of this is a single layer of stones covering an area 7 feet east and west by 4 feet north and south. At 9 feet out from the middle of the west wall is a platform 7 by 7 feet, its west edge on large stones in place. At the west end of the north wall are three large flat stones, one of them forming the corner, the two others west of this, the three being up-edged and in a continuous line.

Within the inclosure, at the southern end, is a closely laid pavement formed of a single stratum of loose stones, laid on the earth, and covering a space 20 feet east and west by 10 feet north and south. Along the inside of the wall, at the northeast corner, is a similar pavement 12 feet north and south by 4 feet 6 inches east and west, and a foot high. Both of these pavements were probably intended for seats and beds. On the larger pavement, 5 feet from the south wall, 9 feet from the east corner, was a boulder, its diameters 11, 12, and 15 inches, whose largest surface lay uppermost and was hollowed out to form a deep saucer-shaped depression like a mortar; but as there was nothing to grind, it was probably to crack or pound nuts in. At the middle of the southeast quarter of the inclosure was a pile of stones 3½ feet across and 1 foot high; there was nothing under them. Seven feet from the north wall, 10 feet from the east wall, was a fireplace formed of two slabs on the east and west sides and a flattened boulder on the south side, all upedged, the north side being left open. Its bottom was undisturbed earth, a foot lower than the level of the platforms. It would seem, though this is uncertain, that the platforms or pavements were on the original surface level, the unpaved space being cleared out to the level of the bottom of the fireplace, and that this space had been filled with earth blown in by the winds after the spot was abandoned. From outside to outside the upedged stones measured 26 by 28 inches; the space inside 18 by 20 inches. On the west edge was a large grinding stone, the amount of wear on its surface indicating much use. A pavement 4 feet wide reached from the open side of the fireplace to the north wall.

In the cavity was about half a bushel of small stones, most of them burned. When meat was to be baked, a fire was made in the pit and as many of the stones as required were heated; they were placed in the body cavity, in the mouth, and in slits cut in the skin of the animal, which was then deposited in the pit, closely covered, and left until thoroughly cooked. Similar ovens or barbecue holes, and

the same method of cooking, are still in use among the natives in their villages.

Views of this house site and of the fireplace, taken from various directions, are shown in plates 38–40.

Nearly north of the house site (A), at a distance of 91 feet, is the similar structure (B). The ground on which this is built is 6 feet lower than at (A). Its measurements are 23 by 24 feet outside, 13 by 18 feet inside, longest north and south. The entire interior is paved. For a space of 8 feet from the north end the pavement is a foot higher than in the south end. Beginning at the foot of the south wall, on the outer side, and extending for 29 feet toward (A), there is a closely laid stone pavement 10 feet wide at the wall and gradually diminishing to a width of 5 feet; its termination is nearly square, the slight curve being apparently not intentional. The west edge of this pavement is in a straight line, the east edge being curved.

Partial views are given in plate 41.

Neither (A) nor (B) has any opening for a doorway, nor is there any apparent method of easy entrance, though a slight platform on the north side of (A) may have supported steps of wood.

These walls, as in all other heavy structures observed, were made by carefully laying up two rows of large stones at a little distance apart and filling the space between them with stones of any convenient size, thrown in at random. Timbers set in them formed the skeleton structure of a house which was completed of poles and smaller growth, the sides and roof being thatched. The weight of the stones held the main timbers against the force of the wind even in severe storms.

The surface over hundreds of acres around these ruins is covered with house sites, long straight rows of stones, and garden lots surrounded by stone walls. Shop refuse, mostly chips and spalls from adz making, sea shells broken to extract the mollusks, coral for abrading, adzes in all stages of finish, and many "olimaikis" (chunkey stones) are found. A mile away is a chunkey yard or bowling alley about 600 feet long on the crest of a ridge which overlooks the ocean on both sides of the island.

THE RAIN HEIAU

A mile from the Cooke residence is a peculiar structure, said to be the only one of its kind in the entire Hawaiian group. Native tradition has it that "a long time ago" a rain wizard who was angered by the people of this district sent such rains that everything was on the point of being washed out to sea. Another wizard told the people to make a heiau (temple, or sacred building) with many

a, Heiaus A and B, on Molokai Island, looking west

b, Heiau A, on Molokai Island, looking north

c, Heiaus A and B, on Molokai Island, looking south

a, Heiau A, on Molokai Island, looking south

b, Platform in Heiau A, looking southeast

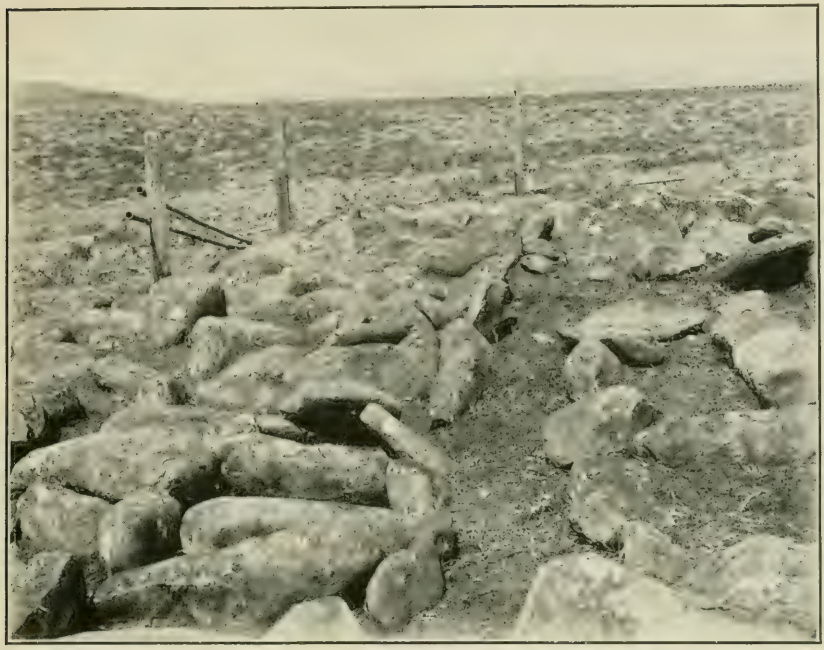
c, Paved way in Heiau A, looking southwest

a, Paved way in Heiau A, looking north

b, Fireplace in Heiau A

a, Heiau B, on Molokai Island, looking northwest

b, Heiau B, showing stone-paved interior, looking northeast



a, The "Rain Heiau," Molokai Island, looking west

b, The "Rain Heiau," looking south

a, The "Rain Heiau," looking north

b, The "Rain Heiau," looking southwest

a, The "Sacrifice Stones" on Molokai Island, looking southwest

b, The "Sacrifice Stones," looking west

a, The "Sacrifice Stones," looking northwest

b, The "Sacrifice Stones," looking south

small compartments which were to be left uncovered in order that the raindrops, each of which was as large as a man's head, could be caught and held in them, and burned. The rain would cease when the first wizard learned that he was being circumvented.

As it now remains, this heiau consists of flat stones placed on edge to make an inclosure 30½ by 20½ feet across the center, the length of the walls being 27½ feet on the north, 31½ feet on the south, 19 feet on the east, and 23½ feet on the west. At the middle is a minor inclosure, similarly formed, 5 feet 8 inches by 3 feet 8 inches, longest north and south. This is a kind of "altar" or "praying place." From it a narrow passage, 12 to 18 inches wide, extends to the middle of each side. In each of the four divisions thus formed other stones were placed to form box-like spaces of diverse shapes and dimensions from 9 by 15 to 20 by 28 and 15 by 45 inches. All the stones were set on the surface, braced against one another; no excavation was made to hold them. They have been somewhat displaced so that the exact number of the boxes can not now be ascertained, but there are somewhere between 110 and 120 of them.

Partial views are shown in plates 42 and 43.

THE SACRIFICE STONES

On the south side of a ravine with steep slopes and bowlder-strewn bottom, half a mile from the "Rain Heiau," is a pile of stones, most of them the natural outcrop, but some of them intentionally placed. The entire mass measures about 27 feet across each way. The highest stone is a weather-worn slab, with the upper surface somewhat convex, 6 feet 9 inches long, 2 feet 3 inches wide on the bottom, 1 foot 3 inches wide on top, 1 foot 4 inches thick. It lies nearly east and west, the upper end on the ground, the lower end on a large bowlder, beyond which it projects for 28 inches. Beneath this, with a space of 8 inches between them, is another stone, 5 feet long, 2 feet 4 inches wide, and 10 inches thick. Its upper surface is concave, the entire margin being higher than the central portion. It lies north and south, the southern end being supported by three small superposed slabs.

These two are supposed to be sacrificial stones, on which victims were extended at full length, face downward. In this position they were easily slain by being decapitated or the neck or head being broken with a club or a stone. That they were utilized for some definite purpose is evident from the fact that the projecting ends of both have been broken off square, the spalls splitting back along the undersurface.

Views are given in plates 44 and 45.

On the opposite slope of the ravine from the sacrifice stones are two old dancing platforms, made by digging the earth down on the

hillside to form a level area, the lower margin of which is supported by a high wall of heavy stones. Near the platforms, on the steep slope, is a space of a fourth of an acre surrounded by a stone wall; and a row of stones marks and preserves a trail or path from them to the bottom of the ravine, terminating at what seems to be a small reservoir surrounded by stones and earth, with a dam above and to one side of it to shut out storm water.

One hundred and fifty yards up the ravine from the dance platforms are two large artificial depressions in weathered bowlders. They have the appearance of mortars or nut-crushing holes, but are supposed to be for catching water during rains, as it is known that the natives made these miniature reservoirs or catch basins, the water being dipped out into vessels as it accumulated.

HAWAII ISLAND

There are reports of former heiaus, house sites, etc., in and around Hilo, and there are numerous so-called "caves," many of which were used by the earlier natives as receptacles for their dead. The term "cave" is not to be taken in its usual meaning of a cavity due to erosion by water, or the small recesses due to wind scouring. In the Hawaiian Islands it means a tube or tunnel; a hollow space due to gas expansion; or a hole formed by gas or steam expansion or explosion in the lava while it is still soft or flowing; and which is now accessible where the top has fallen in or where it has reached the face of a cliff. These still exist practically as they were at the time of their formation.

Of remains upon the surface, the clearing-up processes necessary for cultivation, and the improvements in and around the towns and villages, have either entirely destroyed them or so defaced them that they are now only shapeless ruins. Most or all of the near-by caves are in lava flows of comparatively recent origin and no reports of interments in them could be definitely verified. Human bones were found in three caves near Olaa, 10 miles from Hilo, but no objects of any sort were with them. The condition of the bones showed they had not been long deposited; in fact, with one skeleton were hobnailed leather shoes, with the bones of the feet still in them.

Three skeletons were discovered in a small cave near the dock in making an excavation for a railway cut. An old man living in the vicinity protested vigorously against any disturbance of them, saying they had been his friends and he had helped bury them. In deference to his sentiment the line of the track was deflected so as not to disturb the spot.

Nearly all of the bones mentioned above were soft and decayed, owing to the water which had percolated through the roof and dripped on them.

KILAUEA

It seemed probable that burials, or places where religious rites had been performed, might be found in the vicinity of the volcano. A number of caves were visited, but no evidence could be found to indicate that bodies were ever deposited in them, and persons living in that region had never heard of anything of the sort being found. A few of the caves were dry, but most of them were wet or have become obstructed by falling in of the sides or roof. Ledges and terraces within the ancient crater may contain graves, but lava flows and ash deposits have obliterated all traces of such if they ever existed.

WAIMEA

From 2 to 4 miles west of Waimea, on both sides of the road to Kawaihae, are numerous stone walls, house sites, garden inclosures, taro terraces, and other forms, of uncertain use and purpose. The remains extend over many hundreds of acres. It is said that up to about 1840 this was an important town, containing at one period about 17,000 inhabitants.

QUARRY ON MAUNA KEA

Waimea is the point from which to start for the quarries where the ancients obtained the hard black stone for making adzes. A great amount of work was done there, and refuse is abundant. It is 48 miles from Waimea to the quarries, part of the way by cattle trail through rough country, and they are at an elevation of more than 10,000 feet, considerably above the winter snow line. An examination was not attempted, as a visit to them involved securing a camping outfit and hiring guides and helpers at exorbitant wages.

KAWAIHAE

The "Great Temple" built by King Kamehameha I is on a bluff 100 feet high, separated from the beach by a low level space 100 yards wide. This flat contains many stone structures, but their number, design, and character can not be ascertained on account of the almost impenetrable growth of algaroba. One of them is a rectangle about 50 by 150 feet, the walls high and thick; probably it is an older temple. There is some modern work here, because in one place a wall is cemented, perhaps by ranchmen.

The "Great Temple" measures 80 by 200 feet on the outside, 50 by 150 feet inside, longest north and south. The two ends and the side toward the land are nearly intact and from 10 to 20 feet high according to the surface of the ground. At the north end, inside, is a platform 80 feet north and south by 45 feet east and west, the

four walls carefully and regularly laid up, the space within them filled with large stones, and the surface leveled with beach pebbles. It ends 4 feet within the wall next the sea, the top of this wall being on a level with the bottom of the platform. At the south end is another platform 40 feet east and west by 20 feet north and south, abutting against the east and south walls. A step or terrace 6 feet wide extends the full length of its north side. It has a less finished appearance than the platform at the north end. The central space, between the two, is paved with large stones which apparently pass under both platforms and extend from the foot of the east wall nearly to the west wall, a slight ditch separating it from the latter. The west wall stands below the top of the slope, and its outer face is from 10 to 20 feet high, in three platforms each 8 feet wide. On the slope below are several structures a few feet square formed by two parallel rows of stones with a cross wall at the lower ends, the cellar-like space thus inclosed being filled with pebbles to a level with the top of the walls.

From the northeast and northwest corners long walls extend northwest and southwest toward the beach. Their outer ends are lost in the thicket.

EAST POINT DISTRICT

From Kapoho southward to Kalapana and beyond many remains are reported, but residents say they are of rather modern date, some of them having been occupied since white people came into the country to live. Lava flows of recent date have covered a few.

NAPOOPOO

The large heiau at which Captain Cook made his landing, and where he allowed himself to be worshipped as a god, is about in its original condition, having been repaired in recent years. When Captain Cook attempted to seize the King as a prisoner, the natives naturally rallied to the King's defense. A stone or other missile struck Cook on the head.

Early in the last century an old Hawaiian who as a small boy witnessed the affray told Rev. Mr. Paris (as related by his daughter) that if Cook had been the god he pretended to be, the blow would not have hurt him; but when he fell with a loud groan the people knew he was only a man like themselves and, enraged at the deception practiced on them, quickly made an end of him.

HONAUNAU

The wall of the City of Refuge is nearly intact, as is that of the large heiau. Another heiau was destroyed by a tidal wave. The place is now a public park. Stokes, of the Bishop Museum, has done

much work here and at Napoopoo. The result of his labors will be published.

KEAUHOU

The "Slide," made here in the time of King Kamehameha I, consists of two stone walls from 50 to 75 feet apart, the space between them being filled with stones to provide a level surface from side to side and to equalize the slope from top to bottom. It begins a mile from the foot of the hill, and its terminus was on a level area near the coast. The lower end is now so displaced and overgrown for a fourth of a mile that it can no longer be traced; the remainder of it is practically intact. The slope is not uniform, being somewhat determined by the natural surface, so that it is steeper in some parts than in others. Near the upper end some short stretches are quite steep, presenting from below the appearance of terraces. In places, flat stones are laid pavement fashion from side to side, or rows of stones which seem to be the tops of walls extend across. These were probably to prevent crawling of the smaller material used as a leveler. The slide, according to an old Hawaiian, was covered with one variety of grass, on which was laid another variety; but he could not say whether the two layers had their stems parallel or crosswise. Kukui-nut oil was used plentifully to act as a binder and to give a slick surface. The "sliders," as well as he could remember the description of them, were like sleds with runners; not flat boards like a toboggan. Small depressions here and there, either basin-shaped or well-shaped, have led to excavations in the hope of finding something; but they are due only to falling-in of tubes, tunnels, or bubbles in the lava.

A somewhat similar but very much smaller slide is said to be on the coast 40 miles south of this one. At present it can be reached only from the shore, making a canoe voyage necessary.

Two ruined and overgrown heiaus are near the water line a mile from the slide. Both are built on bare lava, and at very high tides waves dash over them. Possibly the shore has sunk since they were built. Near by, on the flat lava, covered by every tide, are rock carvings rudely resembling the outlines of human figures. They must be of rather recent origin, as the stone is constantly subject to wear by the shingle. Stokes has copied them.

MOOKINI

At the extreme northwest corner of the island of Hawaii is a heiau in excellent preservation, there being but few fallen stones. The ground around is entirely free of growth except for grass and a few weeds, which may explain its appearance of newness; it has a very modern aspect, though it seems to antedate the discovery. It

measures 120 by 275 feet, longest east and west. The east wall is 11 feet high with a narrow terrace from end to end about midway the height. The north wall is 18 feet high. The south wall, which is in a somewhat irregular line, is 5 to 6 feet high. On the outside of the south wall, which forms one side of each, are two inclosures. One, near the east corner, measures 65 feet east and west and 15 feet wide, with its west wall at the edge of an opening which gives access to the interior of the heiau. The wall of this inclosure is 4 feet high. The other inclosure measures 21 feet east and west by 28 feet north and south, the west end flush with the west end of the temple. Its wall is 3 feet high.

The main west wall is 12 feet high. A platform 2 to 4 feet wide, probably a seat or bench, extends along the inside of the south wall. An interior wall 4 feet high, not straight but approximately parallel with the north wall, with a space 10 to 15 feet wide separating them, has one end against the east wall, the other end coming near enough to the west wall to leave only a narrow passageway.

The entire space inside is paved with large stones; on these, as a floor, are several walls whose purpose is not clear; they run in various directions. Near the west end are some small inclosures, also a raised platform in which are 13 "wells," said to be intended to "hold the blood of those offered up as a sacrifice." Possibly the bodies or bones of victims were placed in them, though it is more probable that they held posts or idols.

On the outside, 20 feet from the west wall, is a "sacrifice stone," 6 by 8 feet, averaging 15 inches thick. It is somewhat dished, with a natural depression 12 inches deep.

The heiau is about 200 yards from the ocean. Walls, like fallen fences, extend diagonally from the corners at the west end; the northern one terminates 200 yards away on an outcrop of lava; the southern one has about the same length and ends 50 feet from a similar wall that reaches in a rude semicircle, convex uphill, for 300 yards to the top of a cliff over the ocean. On the opposite side of a small cove within the farther end of this wall is a stone which is known to the natives as the "Shark" or the "Shark God." It is $8\frac{1}{2}$ feet long, 32 inches across at the widest part, averages 14 inches thick, and has somewhat the shape of a coffin with narrowed ends. Lying just on the break of the slope, it inclines slightly down the bank. The end toward the water is carved in a fairly good representation of a turtle's head; on the opposite end are nine artificial cup-like depressions from $1\frac{1}{2}$ to 3 inches in diameter with a depth rather less than half the width; three are on top, three on the end, three on the lower side. Like any long stone supported at the center with the ends free, it gives a metallic note when struck with a knife or other

small piece of metal. It is already defaced by curious experimenters, and will probably be broken up some day in search of the "treasure" inside, or to "see where the music comes from."

For nearly a mile south of the heiau, covering the space between the ocean cliff and a line approximately parallel to it a fourth of a mile up the hill, are many inclosures and long walls. Low walls surround spaces 10 to 15 feet across, filled level with earth, which are either house sites or burial places. Some inclosures, still smaller, with no break in the wall, are supposed to be graves; and graves may also be marked by the many small piles of stones. Other stone heaps, some straight, some crescent-shaped, from 10 to 20 feet long, all the curved ones convex to the windward, were wind shelters. Some of them are known to be made by modern hunters as blinds in plover shooting.

In at least two places are long parallel rows of large stones placed singly, 1 foot to 3 feet apart, the rows separated by a space of from 4 to 6 feet. One set has a dozen or more rows.

Inside of one of the inclosures, directly up the hill from the old landing, is a large stone with an artificial depression of 2 gallons capacity. It was intended as a mortar for pounding nuts.

LAUPAHOEHOE

An old lava flow has pushed out into the ocean in a shape somewhat resembling "a leaf floating on the water," which is the meaning of the word. It forms a nearly level area of 12 or 13 acres, only a few feet above tide. Toward the outer end are numerous walls and inclosures, mostly in ruins and overgrown with trees and bushes. Some of them are clearly modern; others are ancient. Near the lighthouse are the remnants of a heiau; only a part of its walls can be traced.

A wall 3 feet high, beginning at a large stone at one corner, incloses a space 26 by 27 feet, outside measurement; the interior is filled with earth and small stones to a level with the top of the walls. At the end toward the ocean is a platform 20 feet wide, terminating 50 feet from the sea. On this platform is a space 7 by 12 feet, outlined by large rocks. Halfway between the platform and the water is a wall which may be recent.

Near this inclosure is one hexagonal in outline, the walls 2 feet high, and the space inside, 11 by 17 feet, filled with earth to a foot above the top of the wall.

On top of the bluff, 350 feet above tide level, is a heiau the west wall of which was removed in making a deep cut for the railway. The inside dimensions are 70 feet east and west, 115 feet north and south. The interior area, originally irregular, was somewhat leveled,

and covered with a pavement of cobblestones which were carried up from the beach, as were many of the large stones in the wall. The pavement has been torn up in cultivating the ground. The wall is from 4 to 6 feet high inside. This is a little more than the original height, as it was repaired and raised for use as a corral. Along the outside of the north wall, at the west end, is a heavy wall which, with the main wall, forms a "well," nearly filled with rocks. There are no supporting platforms outside, but along the north and east walls are revetments reaching halfway up the face. The southeast corner is rounded and braced or buttressed. These forms of support have been noticed in only one other place. There is a house site within, at the northeast corner. On the wall, placed there in adding to its height, were a broken taro pestle and a very dense siliceous rock, of high specific gravity, and filled with olivines. It weighs about 75 pounds. The ends have been chipped off to give it an ellipsoidal form, otherwise the wave-worn surface is unworked, except that one of its larger faces is rubbed smooth, almost polished, by use as a grinding stone, for which purpose it is excellently adapted by reason of its unusual abrasive quality.

MAUI ISLAND

There are not many aboriginal structures on Maui, but among those which can be found are some of extreme interest on account of their size and complicated arrangement.

KAUPO, OR MOKULAU

A mile and a half from the coast at Kaupo, or Mokulau landing, at the eastern end of the island, are two large heiaus. As it would have required a week's time and a considerable outlay of money to reach them, by reason of the distance and lack of roads, they were not visited.

WAILUKU

At the mouth of the Iao Valley, a mile north of Wailuku, is a sand dune having a nearly level area of about an acre at each end, connected by a curved ridge whose sharp crest is lowered about 20 feet by erosion. On each extremity is a stone inclosure, with several walls on the slopes below them except on the eastern side, toward the ocean. Here a stream has encroached upon the bottom of the dune to such an extent that only a portion of the inclosure nearer town is still remaining, one side and part of each end having fallen into the ravine. The wall along the opposite, or western, side is buried in the sand, only the highest stones still projecting. From the north wall a facing of large stones extending down the surface of the dune for a vertical

distance of 15 feet has prevented erosion by the winds. No protection was necessary below this point as the action of rain water on the lime from disintegrated coral rock contained in the deposit has caused the sand to "set" or harden.

The other heiau, at the north end of the dune, is apparently unfinished. None of it has disappeared, but the plan is difficult to make out. At its northern end is a protecting layer of stones reaching 25 to 30 feet down the slope, in three separate terraces. Similar terraces are on the slope below the southern end of the east wall. Here and there within the structure are well-like spaces filled with stones. The purpose of these is unknown. Stones of varying sizes, mostly small, within the walls indicate a pavement or floor, but the dense growth of lantana brush and the accumulated sand preclude any careful examination or accurate description of these remains.

WAIHEE

Southward from the mouth of the Waihee Valley, 5 miles north of Wailuku, is a range of sand dunes from 200 to 300 feet high, extending for half a mile or more in a wide curve, with the concave side facing the ocean. The level space thus bounded is about a fourth of a mile in its greatest width and contains 50 or 60 acres. Approximately parallel with the windings of the shore line, at an average distance of 200 feet from it, is a strong stone wall, built at an unknown date but prior to the advent of the whites. The plain purpose of this wall was to protect from high tides the low land lying behind it and reaching nearly to the foot of the dunes. This area is now cultivated in a variety of crops, mainly rice. Formerly it was a great taro patch of a Hawaiian settlement. A modern flume, which follows closely the line of an ancient ditch, brings down the necessary water from Waihee Creek.

In front of the wall a space of 5 or 6 acres is covered with a stone pavement on which are the walls of old houses and inclosures. They are protected on the seaward side by thousands of cubic yards of water-worn stones, piled up like a revetment or riprap, which terminate abruptly at the southern end but extend to the mouth of the creek at the north. The dunes show many angular rocks of the same general material, in their lower portion, so they all probably belong to a spur or projection from the mountain, washed clean at the front by waves, and covered at the rear by the dunes. Some of the stones along the water front were rolled by tides and wave-currents from the débris carried down by the creek from the mountains. At high tides waves surmount this natural breakwater, but spread out over the level pavement and sink between the stones, so that dwellers upon the site were not disturbed by their action.

At its northern extremity the high wall connects with a rear corner of an extensive heiau, which was either never completed or has been partially demolished. The unfinished appearance of this, as of all similar remains, is explained by the natives as being due to the interrupted efforts at their construction by "the little people" (fairies), thousands of whom took part in the work. They must complete their task in one night; at the first gleam of dawn they must instantly disappear, leaving their work as it was at the moment, and could never gather at that spot again.

The highest part of the heiau wall still upright is about 10 feet; but some of the stones within, promiscuously heaped, are 2 to 3 feet higher. The structure is about 100 by 250 feet, longest on the line from water to hill. A cross wall, possibly somewhat modified in recent times, divides it into two unequal parts, the seaward portion being nearly square and 5 feet higher than the part at the rear. On the latter are small inclosures of stone, the space within them paved with gravel. If of the same age as the remainder of the structure they may have been for priestly seclusion or preparation, though they may be houses of later natives who took advantage of the foundation made by their ancestors.

Measurements or clear descriptions of these remains are not possible, owing to overgrowth. A satisfactory study, to distinguish between ancient and modern parts, or between undisturbed stones and those not in their original position, would require careful survey with transit and level after the brush is cleared away; and this must be followed up with considerable excavation as well as removal of loose rock; all of which would demand the labor of a dozen men for three months. Even at that, there is no certainty that definite knowledge would be gained; but it is not to be had in any other way.

BURIAL PLACES

Near the top of a remnant of a crater rising from the shore line of the ocean, 11 miles from Wailuku on the road to Kahakuloa, is a stone wall built on the leeward slope, the only place on which it could be constructed, as much the larger part of the crater has been blown out into the sea. Between the wall and the summit are at least a dozen stone-covered graves; possibly there are others not seen, as much of the brush is impenetrable. Some of them are sunken; others appear quite recent.

Many such graves are found on the dunes. They are all modern, some of them still surrounded by the original wooden fences.

IN THE IAO VALLEY

The deepest valley on Maui is that of the Iao River. The sides, nearly vertical in places, have an elevation of about 3,000 feet. About 2 miles above the town of Wailuku, well within the mountain, are walls made of stones of varying sizes up to half a ton or more. They extend over several acres of land and their structure is quite complicated. Mostly, they are borders of taro patches, though some of them mark house sites or garden inclosures. One wall, supporting a terrace, is 8 to 10 feet high and contains very heavy stones.

Near the head of the Iao Valley there are fully 40 acres of taro beds. A trail formerly led from this spot to the south shore of the island, near Lahaina. It can not now be traced, being obliterated by slides.

Residents of Wailuku say these places were in use only 50 or 60 years ago.

Many evidences of former occupation have been destroyed in operating the extensive sugar plantations.

KAUAI ISLAND

There seems to be less evidence of Hawaiian occupancy on Kauai than on any other of the five principal islands. Comparatively few heiaus are reported. Some of those which were in existence when the whites came have been destroyed or defaced to such a degree in establishing sugar plantations that their original form is uncertain; while others are so covered with vegetation, either natural or due to cultivation, that nothing definite can be ascertained as to their size or structure.

The site which might be considered as possessing the greatest interest is an aboriginal quarry and workshop where material for stone implements was obtained and shaped into desired forms. There can be no doubt as to the existence of such a place; but no one now knows its location, unless it be some of the older Hawaiians, who, however, profess entire ignorance in regard to it. Mr. William H. Rice, of Lihue, once induced some natives to conduct him to the spot. He believes that if he alone had gone his guides would have fulfilled their promise; but unfortunately several other men joined him, and the natives, either suspicious of their intentions, or not wishing the premises to become publicly known, pursued a devious and wearisome journey through the jungle, crossing gulches and clambering up and down cliffs until the white men were thoroughly bewildered and exhausted; then announced that they "couldn't find it," and led the party home.

LIHUE

At Niumahu, 2 miles from Lihue, on the road leading south and west from the harbor of Nawiliwili, is a fish pond known as Alakoka. It is a short distance above the mouth of the river, where the little valley widens in a half-moon shape, the stream flowing close to the bluff on the right. The bottom land on the other side is so low as to be swampy. Along the river bank on this side is a heavy wall of stone and earth, reaching the higher land at each end, thus forming a pond of 15 or 20 acres in which the ancient Hawaiians kept their surplus catch of fish. The wall has been raised and strengthened by its present owner, a Chinese, who raises ducks instead of fish.

WAILUA

Near the mouth of the Wailua River, 6 miles from Lihue, is the former abode of the royal family. The place is so overgrown, except in the few cultivated spots, that no examination of it can be made. No traces of the residences are apparent, although the stone boundary walls of the grounds are still standing. The site of the royal cemetery is set aside as public property. There is nothing now to indicate that any interments were ever made in it. The "Birthstone," on or by which all prospective heirs to the throne must be born in order to insure their right to the succession, still lies in the brush near the foot of a little cliff. In case of a dispute among the claimants to the throne this stone had the power, by some means of which the knowledge has now been lost, to determine which, if any, of the contestants was entitled to possession.

The "Sacrifice Stone," also, is in its original place, being so large that it can not be easily removed. Formerly this had a grass roof over it, supported by high poles. When the victim's life was extinct his body was suspended to a rafter or crossbeam at the top of the structure and left there until the flesh had decayed. The bones were then interred on top of the bluff in the rear. It is said that the corpses of chiefs and others of high rank were wrapped in banana leaves and steamed until the flesh fell away. The skeletons were then buried.

A mile from the mouth of the Wailua River, on a narrow plateau between it and a small tributary, the summit level being about 200 feet above the water, is a heiau in fairly good condition. It is one of the large structures of its kind, but is so overgrown that measurements or close description are not possible. It is supposed to be the one which was sacred to the devotions of the highest priesthood. The common people were not allowed to venture near it, and even the king could not visit it without special permission involving the most complicated ceremonies. It has passed into possession of the county and

will be restored as nearly as can be to its pristine state and thus preserved.

On a mass of loose rocks, resulting from disintegration of an old lava flow, projecting into the ocean half a mile east from the mouth of the Wailua River, and near the race track, is a heiau of irregular construction. The extreme measurements are 80 feet north and south by 200 feet east and west. The wall on the side toward the sea is higher and wider along the central half than it is nearer the ends. Small inclosures, bounded by single rows of stones, probably mark the sites of houses for priests and attendants. Along the inner side of the wall next to the water are four depressions, remains of partially filled well-like or cistern-like excavations; similar hollows, obscured by brush, are also next to the inner foot of the opposite wall. A large rock in the form of a triangular prism, standing upright, with one end firmly imbedded in the ground, was no doubt a "god" of some kind; it has a slight hollow or "cup" pecked in the flat top. There are several irregular rows of stones outside of the inclosure. Dense growth prevents the examination necessary for a closer description.

DUNE BURIALS

Four miles east of Lihue a spur of the plantation railway was run into the dunes to procure sand for making fills. In the course of this work human bones were found, the remains of one individual in one spot and of at least two others not far away. None of these bones seemed to have been long underground. Search in the vicinity, over bare spots among the ridges whose upper portions have been carried away by the winds, revealed indications of burials in at least six other places. Such bones as were found were decayed or in fragments. Among them was part of the skull of a very young infant. A quantity of cooking stones, some coral rasps or files, and a much weathered fragment of a wooden bowl, denoted that camps had been made on the dunes. As the beach is smooth, firm, and extensive, providing an excellent place for landing canoes or dragging seines, these remains probably pertain to parties or families who maintained fishing camps here.

At the mouth of the Wailua River, on the east side, was a "City of Refuge." It is now partially destroyed, many of the stones having been taken away to make a fill in the road. It was rectangular in form, 360 feet east and west, 60 feet north and south, made of large stones, some of them weighing a ton or even more. The eastern portion of the interior is artificially made a foot higher than the western. The structure is 300 feet from the water. Midway down the gentle slope in front, opposite the western end, is a slightly crooked row,

100 feet long, of very large stones. A similar row is near the water on the side between the inclosure and the river.

WAIMEA

There were formerly several heiaus within a few miles of Waimea. Some of them have been destroyed by cultivation, while others are difficult to find and impossible to examine in the cane fields or dense brush.

At the east foot of a rocky peak 13 miles by road from Waimea, at an elevation of more than 3,600 feet, is a small heiau almost on the brink of the canyon. Within the walls it is 30 feet across each way. On the south line are three large stones in line, one at each corner, the third about midway between them. No doubt their position determined the location of the structure. It stands on a slight slope. The west wall is 2 feet high inside, the earth having washed down level with its top outside. The north wall is a foot higher than the floor at the west end, and is completely buried at the east, as are the south and west walls along their entire length except for a protruding stone here and there. In fact, the whole interior seems to have received a heavy deposit of earth, carried in from the outside by wind and rain. All these features give an appearance of antiquity to the ruin.

Directly below it, well toward the bottom of the canyon, which is said to be 3,000 feet deep, is a long, narrow, curved ridge with rounded top and almost vertical sides. The upper part, apparently an old lava flow, is darker in color than the surrounding precipices, its surface checkered and seamed by weathering and erosion, so that it has an almost startling resemblance to a huge serpent crawling out of the side of the mountain and, with head laid flat on the extreme point of the cliff, watching something in the stream bed a thousand feet below. If the old Hawaiians had been familiar with ophidians, as were the American Indians, this "Snake God" would no doubt have held high rank among their divinities.

CONCLUSIONS

As intimated above, much additional information regarding antiquities in the Hawaiian Islands can be found in publications of the Bishop Museum in Honolulu. Descriptions, with illustrations, of a number of heiaus are given by Mr. Thrum in the "Hawaiian Annual" for 1906 to 1910, inclusive; and his forthcoming volume will completely cover this branch of archeology. The Bishop Museum has undertaken to make a complete survey and report of all the ancient remains, while Dr. Brigham has almost finished for publication an exhaustive treatise which will include all his observations

and deductions along the same lines. With these tasks ended, there will be nothing for anyone else to do, except to take measures for the restoration and care of the principal structures.

All the aboriginal remains on the islands are the work of the present Hawaiian race. When the earliest of these people came here they found the islands without inhabitants. There are no evidences of any prehistoric population nor any indications whatever of underground remains. Consequently, so far as can be ascertained, excavations would not result in the discovery of any prehistoric objects or of anything essentially different from what can be seen on the surface or found slightly covered by very recent natural accumulation. At the same time, all the remains are well worthy of study and preservation. These conclusions meet the full approval and indorsement of both Mr. Thrum and Dr. Brigham.

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